# Notes

This aff has the Fish and Wildlife Service do some stuff with genetically engineered fish (what stuff depends on which version of the plan you read.) There are two pretty distinct purposes for the transgenic fish

1. To regulate invasive species-Transgenic fish can be designed to be sent in to eradicate invasive species because of something called the “Daughterless gene” effect or “Trojan gene effect”
2. To feed more people by being able to grow more fish-For example, they can shorten the life cycle for growth in salmon so that more are produced quickly

There is a LOT of overlap between this and a traditional aquaculture aff- You should integrate those two files as appropriate should you choose to read this aff (and will also need to do so to debate it on the neg.) I’ve included the most important things, IE, answers to the food security advantage, etc., thanks to Jason Peterson’s file for that.

# Aff

## 1AC

### 1AC Environment Advantage

#### Advantage One is Invasive Species

Arctic shipping ballast water means the threat from invasive species is increasing in the status quo-They’re a Pandora’s Box

Geiling, 6/27 Natasha, online reporter for *Smithsonian* magazine, “The Arctic shipping boom-a bonanza for invasive exotic species,” <http://www.theecologist.org/News/news_analysis/2450823/the_arctic_shipping_boom_a_bonanza_for_invasive_exotic_species.html>, ALB

As the Arctic warms and its ice melts, growing numbers freight ships are reaping big savings from the 'Arctic short cut'. But this is creating a huge risk of invasive species spreading in ballast water and on hulls - disrupting both Arctic and temperate ecosystems. Invasive species are always cause for apprehension - a Pandora's Box, because no one really knows how they'll impact a particular ecosystem until it's too late. On September 27, 2013, the Nordic Orion, a commercial bulk carrier owned by the Copenhagen-based shipping company Nordic Bulk Carriers became the first bulk carrier to cross the Northwest Passage - a route that connects the Pacific and Atlantic Oceans above Canada. It arrived off the coast of Greenland after departing from Vancouver, BC, ten days earlier. The ship was loaded with British Columbian coal, and was able to haul 25% more than it could have carried if it had been forced to take the Panama Canal, where ships have to sail higher in the water and carry less. The route, which snaked through Canada's Arctic waters, saved the shipping company nearly four days and $200,000 by the time the ship reached its final destination in the Finnish port of Pori. But the ships are carrying more than just cargo This shortcut wouldn't have been possible decades ago, but because of a reduction in Arctic sea-ice coverage in recent years, ships are now able to navigate more northerly passages, both through Canada's icy waters, and in Russia and Norway's northern seas. But cargo isn't the only thing that they're transporting: some marine biologists worry that ships carting cargo through the Arctic's newly opened waterways are introducing invasive species to the area - and bringing invasive species to some of America's most important ports. For centuries, explorers have been searching for a Northwest Passage - a route connecting the Pacific and the Atlantic. The search for the Northwest Passage was the entire basis for Lewis and Clark's famed expedition. And they weren't the first, nor the last, to go looking for it. As it turns out, these expeditions were just a bit early: rising global temperatures have caused Arctic waters to warm, decreasing the amount of ice cover. The melting Arctic opens new shipping routes In the past 30 years, the Arctic has warmed more than any other region on Earth. Over that same 30-year period, according to satellite images, Arctic ice cover has declined by 30% in September, the month that marks the end of the summer melt season. Arctic ice loss is a problem for global warming, because it creates a kind of warming feedback loop-less ice means more dark water exposed, which means more sunlight absorbed by the water, which in turn leads to more warming. What Arctic melting isn't bad news for, however, is the shipping industry, where 90% of all goods are moved via carriers. Until recently, ships that wanted to travel between oceans had two primary paths-the Suez Canal and the Panama Canal, both located in warm, tropical latitudes. It's a fast-growing business As warming Arctic waters open up a northern route for shipping, the routes turn out to be more appealing for a few reasons. First, they're shorter, shaving valuable days off of traditional shipping routes. This means faster turn around for ships, and less fuel, all of which translate into big savings for the industry. Container ships that go through Arctic waters also aren't subject to cargo limits imposed for certain routes, like the Panama canal. Finally, ships passing through the isolated Arctic don't need to worry as much about piracy, adding a level of economic security. An increasing number of ships have been using this new northern network of shipping passages in the past years. In 2013, 71 ships transited the Northern Sea Route, a route that crosses the Arctic Sea along Russia's northern coast. In 2012, the year of the lowest recorded Arctic sea ice coverage, 46 ships made the same crossing. In 2011, that number was 34. Contrast that to 2010, when just four ships made the journey. Nearly 19,000 ships cross the Suez Canal each year. So the number of ships crossing through Arctic waters is likely going to increase: a 2013 study published in PNAS argued that due to global warming and Arctic ice loss, by 2050 even ships not equipped with ice-breaking hulls will be able to navigate Arctic shipping routes. So are people just using the Arctic for shipping? Shipping routes through the Arctic are appealing to shipping companies, but that's not the only reason the Arctic might see more traffic in the coming years: melting sea ice has revealed natural resources ready to be exploited for profit. "A lot of those [natural resources] are submarine, and as the surface ice dissipates, ships can get in there and explore and drill", explains Whitman Miller, a research scientist and assistant director of the Smithsonian Environmental Research Center's Marine Invasions Research Lab. Along with his collegue Gregory Ruiz, Miller also wrote a commentary about invasive species and the Arctic published in Nature Climate Change. "There's also mining", he says. "Greenland, for example, as its ice is melting, is opening up some of the land for mining of rare earth metals, which are really important for a lot of consumer electronics." So, as Arctic ice melts, there will be two types of traffic plying these waters: a kind that uses the Arctic as a thoroughfare between Pacific and Atlantic ports, and a kind that uses the Arctic as a destination for obtaining natural resources. "All of these things mean invasive species - organisms are going to be moving with these ships", warns Miller.

**And, current efforts to control invasive species fail-Genetic biocontrol is key**

**Kapuscinski and Sharpe ‘14**-Anne is in the Environmental Studies Progam at Dartmounth College, Leah is in the Conservation Biology graduate program at University of Minnesota. Introduction: genetic biocontrol of invasive fish species Anne R. Kapuscinski • Leah M. Sharpe, Received: 10 March 2014 / Accepted: 14 March 2014 / Published online: 3 April 2014, http://www.readcube.com/articles/10.1007/s10530-014-0681-6?tab=summary

Current control techniques available for aquatic invasive species are time and labor intensive, expensive, and often lethal for non-target species. Genetic biocontrol technology offers frustrated natural resource managers a new opportunity for a different control strategy. Thresher et al. (2013) review the current state of this technology, which ranges from the well-developed option of releasing sterile males produced by chromosomal manipulations to recombi- nant and Trojan Y chromosome options that are potentially more effective than sterile male release but presently require more research and development. They also explore the potential to enhance the effectiveness of control by using these genetic tech- nologies within an integrated pest management approach. Research efforts have not yet progressed to the point of testing the efficacy of this technology with live organisms in well-secured but ecologically relevant confined mesocosms. Researchers are thus using quantitative models to explore questions about efficacy. Modeling informed by the international symposium suggests that both chromosome and gene manipulations show the potential to eradicate populations of invasive species, albeit requiring time frames on the order of decades to achieve extinction (Teem et al. 2013); and that combining these techniques may speed up the process (Teem and Gutierrez 2013).

#### Fortunately, transgenic fish offer the best solution for invasive species-Biocontrol is most effective

Kapuscinski and Sharpe '14 (Anne Kapuscinski and Leah Sharpe, Environmental Studies Program, Dartmouth College, Biological Invasions, "Genetic biocontrol of invasive", http://download.springer.com/static/pdf/919/art%253A10.1007%252Fs10530-014-0681-6.pdf?auth66=1404077324\_95e00231e1df55b50f44fcde6cd1b3b7&ext=.pdf, ST)

Genetic biocontrol refers to the intentional envi- ronmental release of genetically manipulated organ- isms that are designed to disrupt the survival or reproduction of a targeted invasive species. It involves manipulations of chromosomes of a target species in order to skew sex ratios of the target species, recombinant DNA techniques to insert a deleterious gene construct into the target species’ genome in order to disrupt the organism’s life cycle, or a combination of both techniques. Genetic biocontrol strategies have the potential to better target a specific invasive species of concern and possibly achieve shorter time periods of maintenance than current control methods such as physical removal or rotenone poisoning. Intentionally releasing a genetically manipulated organism into the wild, however, is a controversial idea and raises questions about various risks. Turning genetic bio- control methods into practical tools will require thorough assessment of these risks and identifying ways to mitigate them. Current control techniques available for aquatic invasive species are time and labor intensive, expen- sive, and often lethal for non-target species. Genetic biocontrol technology offers frustrated natural resource managers a new opportunity for a different control strategy. Thresher et al. (2013) review the current state of this technology, which ranges from the well-developed option of releasing sterile males produced by chromosomal manipulations to recombi- nant and Trojan Y chromosome options that are potentially more effective than sterile male release but presently require more research and development. They also explore the potential to enhance the effectiveness of control by using these genetic tech- nologies within an integrated pest management approach. Research efforts have not yet progressed to the point of testing the efficacy of this technology with live organisms in well-secured but ecologically relevant confined mesocosms. Researchers are thus using quantitative models to explore questions about efficacy. Modeling informed by the international symposium suggests that both chromosome and gene manipulations show the potential to eradicate popula- tions of invasive species, albeit requiring time frames on the order of decades to achieve extinction (Teem et al. 2013); and that combining these techniques may speed up the process (Teem and Gutierrez 2013). The promise of genetic biocontrol technologies comes with questions about effectiveness, develop- ment costs, opportunity costs, and ecological risks. Sharpe (2013) reports that stakeholders in focus groups raised all these categories of questions, with their concerns ranging from whether the technology would function as intended in the wild to how to prevent spread of biocontrol organisms beyond the target area. Participants attending the symposium raised similar concerns during the symposium break out groups. The fact that genetic biocontrol technologies requires deliberate release and spread into nature of genetically manipulated organisms makes it paramount to precede any deployment of genetic biocontrol with state-of- the-art environmental risk assessment as outlined by Dana et al. (2013) and using quantitative methods within an evidence-based framework as presented by Hayes et al. (2013). Homans and Smith (2011) present a framework for estimating costs and benefits of genetic biocontrol and investigate the critical issue of when investing in genetic biocontrol is economically justified. These four articles give technology develop- ers a roadmap for responsible development and assessment of this technology.

#### Empirical research of daughterless technology proves

Thresher '14 (Ron Thresher, Ph.D. in fish behavior and ecology at the University of Miami, and did post-doctoral work at Scripps Institution of Oceanography and the University of Sydney. He was the foundation head of the CSIRO Centre for Research on Introduced Marine Pests (CRIMP), " Male-only Gene Trick Could Leave Invasive Fish Species Floundering," http://theconversation.com/profiles/ron-thresher-125113/profile\_bio, ST)

Pin It Carp have spread throughout Australia’s waterways - but CSIRO is hoping to bring a new genetic weapon to bear on them. A genetic modification that creates male-only populations could give us a new weapon against invasive fish such as carp that plague our waterways. “Daughterless technology”, which works by removing females so a population can no longer breed, has previously been used to tackle mosquitoes. But new CSIRO research shows that it also works on fish. The technology is safe and could be used to greatest effect with other forms of pest control. It might also be used to control other vertebrate pests such as cane toads. Invasive European carp have been fouling our waterways and harming our native fish populations since they were first introduced to Australia in 1859 for aquaculture purposes. They became a major pest after the accidental release of a German strain, called Boolarra after the site at which it was being farmed, in the 1960s. They spread rapidly across Australia and quickly reached huge numbers, much like rabbits and cane toads before them. Carp are now the most abundant large freshwater fish in some parts of Australia, including most of the Murray-Darling Basin. It is no wonder they are often referred to as Australia’s “river rabbits”. So far, carp control has mainly involved commercial fishing or poisoning. While these options may reduce carp numbers, and poisoning may occasionally eradicate them from isolated areas, other options are being explored for more widespread control. One notable success was at Lake Crescent in Tasmania, where carp were eradicated using a combination of control methods, including barrier mesh and traps to reduce breeding and capture the fish, and pesticides to kill unhatched embryos. The project also used high-tech tactics, such as “Judas carp” implanted with radio transmitters to locate clusters of fish, and a pheromone “lure” odour to attract and capture mature adults. The daughterless technology being developed by CSIRO could be a useful weapon to add to this arsenal. To find out if daughterless technology works on vertebrates, we tested it on zebrafish. We chose them because they are small, have a short generation time, and are closely related to several invasive carp species. Daughterless technology involves modifying the genes of male fish. The modification is specific to a particular fish species, and there is an extremely low chance of it spreading to other species. When the genetic change is inherited by female fish it reduces either their fertility or survival. The result is that females become more and more rare in the population, eventually driving the pest species to extinction. In our trial, we managed to create a 100% male zebrafish population. Without any females, the group is doomed to die out. The technology is now being tested on carp, at specialist facilities at Auburn University in Alabama. Getting results will take longer than it did for zebrafish, as carp take more time to reach sexual maturity and the technology needs to be tested through several generations. However, the preliminary results are promising – in fact it looks like it works even better in carp than in zebrafish. This type of genetic modification has several advantages. The modified genes are spread through the population by the males, which are not themselves affected, and only through natural breeding events. As carp do not breed with any native Australian species, the risk of the technology affecting anything other than the targeted pest is extremely low.

#### Invasive species cause MASSIVE biodiversity loss-Prefer this awesome conclusive evidence

Geiling, 6/27 Natasha, online reporter for *Smithsonian* magazine, “The Arctic shipping boom-a bonanza for invasive exotic species,” <http://www.theecologist.org/News/news_analysis/2450823/the_arctic_shipping_boom_a_bonanza_for_invasive_exotic_species.html>, ALB

The threat of invasive species Shipping containers and bulk carriers currently contribute significantly to the spread of invasive species - it's something that has been irking marine biologists for a long time. Bulk carriers (and ships generally) have things called ballast tanks, which are compartments that hold water, in order to weigh a ship down and lower its center of gravity, providing stability. Ships take in water from one location and discharge it in another, contributing to concerns about invasive species. The zebra mussel, an invasive species that has colonized the Great Lakes and caused billions of dollars of economic damage, is believed to have been introduced from the ballast tank of ships coming from Western European ports. Shipping is already the primary way that invasive marine species become introduced - contributing to 69% of species introductions to marine areas. And it's only going to get worse But Miller and Ruiz worry that Arctic shipping - both through the Arctic and from the Arctic - could make this statistic even worse. "What's happening now is that ships move between oceans by going through Panama or Suez, but that means ships from higher latitudes have to divert south into tropical and subtropical waters, so if you are a cold water species, you're not likely to do well in those warm waters", Miller explains. "That could currently be working as a filter, minimizing the high latitude species that are moving from one ocean to another." Moreover, the Panama Canal is a freshwater canal, so organisms clinging to the hulls of ships passing through have to undergo osmotic shock as saltwater becomes freshwater and back again. A lot of organisms, Miller explains, can't survive that. These new cold water routes don't have the advantage of temperature or salinity filters the way traditional shipping routes do. That means that species adapted to live in cold waters in the Arctic could potentially survive in the cool waters in northern port cities in New York and New Jersey, which facilitated the maritime transport of nearly $250 billion worth of goods in 2008. And because routes through the Arctic are much shorter than traditional shipping routes, invasive animals like crabs, barnacles and mussels are more likely to survive the short transit distance riding along inside the ballast tanks and clinging to the hulls. Once the genie is out of the bottle ... Invasive species are always cause for apprehension - a Pandora's Box, because no one really knows how they'll impact a particular ecosystem until it's too late. In an interview with Scientific American in March of 2013, climate scientist Jessica Hellmann, of the University of Notre Dame, put it this way: "Invasive species are one of those things that once the genie is out of the bottle, it's hard to put her back in." There aren't many invasive species from the Arctic that are known, but one that is, the red king crab, has already wreaked havoc on Norway's waters. A ferocious predator, the red king crab hasn't had much trouble asserting near total dominance over species unfamiliar with it. "You never know when the next red king crab is going to be in your ballast tank", Miller warns. A twofold danger - economic, and ecological

#### And-Ocean biodiversity loss causes extinction

CBS News November 3 2006 “Salt-Water Fish Extinction Seen by 2048,” [www.cbsnews.com/stories/2006/11/02/health/webmd/main2147223.shtml](http://www.cbsnews.com/stories/2006/11/02/health/webmd/main2147223.shtml)

The apocalypse has a new date: 2048. That's when the world's oceans will be empty of fish, predicts an international team of ecologists and economists. The cause: the disappearance of species due to overfishing, pollution, habitat loss, and climate change. The study by Boris Worm, PhD, of Dalhousie University in Halifax, Nova Scotia, -- with colleagues in the U.K., U.S., Sweden, and Panama -- was an effort to understand what this loss of ocean species might mean to the world. The researchers analyzed several different kinds of data. Even to these ecology-minded scientists, the results were an unpleasant surprise. "I was shocked and disturbed by how consistent these trends are -- beyond anything we suspected," Worm says in a news release. "This isn't predicted to happen. This is happening now," study researcher Nicola Beaumont, PhD, of the Plymouth Marine Laboratory, U.K., says in a news release. "If biodiversity continues to decline, the marine environment will not be able to sustain our way of life. Indeed, it may not be able to sustain our lives at all," Beaumont adds. Already, 29% of edible fish and seafood species have declined by 90% -- a drop that means the collapse of these fisheries. But the issue isn't just having seafood on our plates. Ocean species filter toxins from the water. They protect shorelines. And they reduce the risks of algae blooms such as the red tide. "A large and increasing proportion of our population lives close to the coast; thus the loss of services such as flood control and waste detoxification can have disastrous consequences," Worm and colleagues say. The researchers analyzed data from 32 experiments on different marine environments. They then analyzed the 1,000-year history of 12 coastal regions around the world, including San Francisco and Chesapeake bays in the U.S., and the Adriatic, Baltic, and North seas in Europe. Next, they analyzed fishery data from 64 large marine ecosystems. And finally, they looked at the recovery of 48 protected ocean areas. Their bottom line: Everything that lives in the ocean is important. The diversity of ocean life is the key to its survival. The areas of the ocean with the most different kinds of life are the healthiest. But the loss of species isn't gradual. It's happening fast -- and getting faster, the researchers say. Worm and colleagues call for sustainable fisheries management, pollution control, habitat maintenance, and the creation of more ocean reserves. This, they say, isn't a cost; it's an investment that will pay off in lower insurance costs, a sustainable fish industry, fewer natural disasters, human health, and more. "It's not too late. We can turn this around," Worm says. "But less than 1% of the global ocean is effectively protected right now." Worm and colleagues report their findings in the Nov. 3 issue of Science.

#### Also devastates the global economy

Geiling, 6/27 Natasha, online reporter for *Smithsonian* magazine, “The Arctic shipping boom-a bonanza for invasive exotic species,” <http://www.theecologist.org/News/news_analysis/2450823/the_arctic_shipping_boom_a_bonanza_for_invasive_exotic_species.html>, ALB

Invasive species pose two dangers, one ecological, the other economic. From an ecological standpoint, invasive species threaten to disrupt systems that have evolved and adapted to live together over millions of years. "You could have a real breakdown in terms of [the ecosystems] structure and their function, and in some cases, the diversity and abundance of native species", Miller explains. But invasive species do more than threaten the ecology of the Arctic - they can threaten the global economy. Many invasive species, like mussels, can damage infrastructure, such as cooling and water pipes. Seaports are vital to both the United States and the global economy - ports in the Western hemisphere handle 7.8 billion tons of cargo each year and generate nearly $8.6 trillion of total economic activity, according to the American Association of Port Authorities. If an invasive species is allowed to gain a foothold in a port, it could completely disrupt the economic output of that port. The green crab, an invasive species from Europe, for example, has been introduced to New England coasts and feasts on native oysters and crabs, accounting for nearly $44 million a year in economic losses. If invasive species are able to disrupt the infrastructure of an American port - from pipes to boats - it could mean damages for the American economy.

#### Economic decline triggers worldwide conflict Royal, 10 – Jedediah Royal, Director of Cooperative Threat Reduction at the U.S. Department of Defense, (Economic Integration, Economic Signaling and the Problem of Economic Crises, Economics of War and Peace: Economic, Legal and Political Perspectives, ed. Goldsmith and Brauer, p. 213-215)

Less intuitive is how periods of economic decline may increase the likelihood of external conflict. Political science literature has contributed a moderate degree of attention to the impact of economic decline and the security and defence behaviour of interdependent states. Research in this vein has been considered at systemic, dyadic and national levels. Several notable contributions follow. First, on the systemic level, Pollins (2008) advances Modclski and Thompson's (1996) work on leadership cycle theory, finding that rhythms in the global economy are associated with the rise and fall of a pre-eminent power and the often bloody transition from one pre-eminent leader to the next. As such, exogenous shocks such as economic crises could usher in a redistribution of relative power (see also Gilpin, 1981) that leads to uncertainty about power balances, increasing the risk of miscalculation (Fearon. 1995). Alternatively, even a relatively certain redistribution of power could lead to a permissive environment for conflict as a rising power may seek to challenge a declining power (Werner, 1999). Separately, Pollins (1996) also shows that global economic cycles combined with parallel leadership cycles impact the likelihood of conflict among major, medium and small powers, although he suggests that the causes and connections between global economic conditions and security conditions remain unknown. Second, on a dyadic level, Copeland's (1996. 2000) theory of trade expectations suggests that 'future expectation of trade' is a significant variable in understanding economic conditions and security behaviour of states. He argues that interdependent states are likely to gain pacific benefits from trade so long as they have an optimistic view of future trade relations. However, if the expectations of future trade decline, particularly for difficult to replace items such as energy resources, the likelihood for conflict increases, as states will be inclined to use force to gain access to those resources. Crises could potentially be the trigger for decreased trade expectations either on its own or because it triggers protectionist moves by interdependent states.4 Third, others have considered the link between economic decline and external armed conflict at a national level. Blomberg and Hess (2002) find a strong correlation between internal conflict and external conflict, particularly during periods of economic downturn. They write: The linkages between internal and external conflict and prosperity are strong and mutually reinforcing. Economic conflict tends to spawn internal conflict, which in turn returns the favour. Moreover, the presence of a recession tends to amplify the extent to which international and external conflicts self-reinforce each other. (Blomberg & Hess, 2002. p. 89) Economic decline has also been linked with an increase in the likelihood of terrorism (Blomberg. Hess. & Weerapana. 2004). which has the capacity to spill across borders and lead to external tensions. Furthermore, crises generally reduce the popularity of a sitting government. 'Diversionary theory' suggests that, when facing unpopularity arising from economic decline, sitting governments have increased incentives to fabricate external military conflicts to create a 'rally around the flag' effect. Wang (1990, DeRouen (1995). and Blomberg, Hess, and Thacker (2006) find supporting evidence showing that economic decline and use of force are at least indirectly correlated. Gelpi (1997), Miller (1999), and Kisangani and Pickering (2009) suggest that the tendency towards diversionary tactics are greater for democratic states than autocratic states, due to the fact that democratic leaders are generally more susceptible to being removed from office due to lack of domestic support. DeRouen (2000) has provided evidence showing that periods of weak economic performance in the United States, and thus weak Presidential popularity, are statistically linked to an increase in the use of force. In summary, recent economic scholarship positively correlates economic integration with an increase in the frequency of economic crises, whereas political science scholarship links economic decline with external conflict at systemic, dyadic and national levels.' This implied connection between integration, crises and armed conflict has not featured prominently in the economic-security debate and deserves more attention. This observation is not contradictory to other perspectives that link economic interdependence with a decrease in the likelihood of external conflict, such as those mentioned in the first paragraph of this chapter. Those studies tend to focus on dyadic interdependence instead of global interdependence and do not specifically consider the occurrence of and conditions created by economic crises. As such, the view presented here should be considered ancillary to those views.

#### And, no environment offense-Biggest risk comes from agent confusion, which the plan solves

Johns 2013—Kristen L., Class of 2013, University of Southern California Gould School of Law; B.S. Environmental Systems: Ecology, Behavior and Evolution, University of California San Diego., FARM FISHING HOLES: GAPS IN FEDERAL REGULATION OF OFFSHORE AQUACULTURE, Southern California Law Review, apl

Biological pollution may be caused by the unintentional release of farmed **fish** into the ocean, which can harm native **fish** populations in a number of ways. Nonnative farmed **fish** can compete with native **fish** for food, habitat, or spawning grounds. In the Pacific Northwest, escaped **fish** from salmon farms have threatened or displaced native salmon populations for years, [n66](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n66) while many scientists believe nonnative escaped fish contributed to the extinction and endangerment of several native fish species, such as the bonytail and humpback chubs, the desert pupfish, the Gulf sturgeon, and the June and razorback suckers. [n67](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n67) Because farmed **fish** are either selectively bred or artificially engineered to mature faster and [\*695] grow larger, they can also alter the genetic makeup of wild populations by interbreeding, which can decrease that population's fitness. [n68](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n68) **Scientists and policymakers alike are already calling for regulation of genetically modified or "****transgenic" fish**. [n69](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n69)Finally, escaped **fish** can create biological pollution by introducing parasites and pathogens to native stock, the incidences of which are increased by aquaculture's practice of raising large densities of **fish** in small areas. One deadly pathogen, infectious salmon anemia ("ISA"), was first detected in the United States in Maine in 2001, [n70](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n70) and by 2011 had made its way to the West Coast. [n71](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n71) The virus, highly contagious, can kill up to 70 percent of **fish** on infected farms and could "devastate" Pacific salmon stocks if left unchecked. [n72](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n72) In fact, a 2007 outbreak of the virus was responsible for decimating the Chilean salmon aquaculture industry, reducing production by half and resulting in more than $ 2 billion in losses. [n73](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n73) Notably, the risk of escaped **fish** may be higher in offshore aquaculture facilities since they are often more susceptible to damage by storms and are more likely to experience accidental releases of **fish** and their pathogens. In fact, net pens - the kind currently used in most offshore [\*696] facilities - are "extremely prone to **fish** escapes" because of their vulnerability to storm damage, accidents during transfers, and damage from boats or other marine life. [n74](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n74) Indeed, nearly one hundred thousand Atlantic salmon escaped from net pens in Washington in 1996, with another three hundred thousand escaping from a single farm in 1997. [n75](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n75) Any potential offshore facility, therefore, must be regulated and managed to avoid this risk. **While the application of overlapping jurisdictions to offshore aquaculture can lead to overregulation of certain environmental risks, it can also lead to underregulation of other risks. The impact of escaped nonnative and** **transgenic fish** on native species **is especially likely to avoid regulation.** Although the FDA has stated it intends to regulate the use of **transgenic fish** in aquaculture facilities, it has yet to promulgate any rules and has little expertise in dealing with impacts other than those on human [\*701] health. [n98](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n98) **The EPA may have authority to regulate escaped** **fish under the Clean Water Act, but only if the farms are considered "point sources" and only if the escaped** **fish are considered "pollutants."** [n99](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n99) **The Endangered Species Act may give authority to NMFS or EPA to consider the impacts of escaped** **fish on certain native species, but only if those species are listed as "threatened or endangered" by the federal government,** **[n100](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true" \l "n100) which only a few of the species involved in aquaculture are**.

### Food Security Advantage

#### Aquaculture is the key internal link to food security-But reform is key

Sara Hughes, Bren School of Environmental Science and Management, University of California, Santa Barbara, and Joan B. Rose, Michigan State University, 2014 “Governing Aquaculture for Human Security,” <http://www.fisheriessociety.org/proofs/sf/hughes.pdf>, ALB

Food Security and Nutrition¶ Aquaculture development has the potential to contribute to food security in many places by closing¶ the gap between the rising demands for fish and declining capture fisheries. According to the¶ FAO’s 2008 State of World Fisheries and Aquaculture report, “aquaculture is for the first time set¶ to contribute half of the fish consumed by the human population worldwide,” a trend that they¶ say reflects “not only the vitality of the aquaculture sector, but also global economic growth and¶ continuing developments in fish processing and trade” (FAO 2008b). A reliable and accessible¶ food source is a pressing concern for significant portions of the population; at the same time,¶ overfishing is predicted to result in reduced fish catch and changes to food web structure (Pauly¶ et al. 2002; FAO 2008b). Such trends raise questions about the ability of fish to meet growing demands¶ without substantial changes to management strategies (Botsford et al. 1997), particularly¶ in Asia and regions where livestock and other sources of protein are relatively scarce (Bell et al.¶ 2009). Indeed, fish consumption in Asia and Africa (17% and 26% of animal protein, respectively)¶ is nearly triple that of western countries (Tidwell and Allan 2001). As the human population¶ continues to grow, aquaculture will play an increasingly important role in global food security.¶ Fish are a highly nutritious food source and already constitute a significant source of protein for¶ more than one billion people worldwide (FAO 2003). According to the World Fish Center, “fresh¶ fish is 18–20% protein by weight and contains all eight essential amino acids. It is a rich source of¶ vitamin A for good vision and robust immunity, B vitamins for metabolizing energy, vitamin C to¶ aid the absorption of iron and fend off anemia, and vitamin D for bone growth” (World Fish Center¶ 2007). These nutrients are lacking in the diets of many people in the developing world where staple¶ grains and tubers are often more accessible and affordable. Studies have found that improved nutrition¶ through fish and fish oil consumption can even reduce the frequency of hospitalization and¶ maintain body weight of HIV patients (Stack et al. 1996). Aquaculture development increases the¶ availability of fish, and the food security benefits of a thriving and sustainable aquaculture industry¶ could be extraordinary for many parts of the world.

This is especially true in the face of exploding population growth

The World Bank, 2013, “Fish to 2030: Prospects for Fisheries and Aquaculture,” Agriculture and Environmental Services Discussion Paper 03, ALB

The World Bank Group (WBG) Agriculture Action Plan 2013–151 summarizes critical challenges facing the global food and agriculture sector.¶ Global population is expected to reach 9 billion by 2050, and the world food-producing sector must secure food and nutrition for the growing¶ population through increased production and reduced waste. Production increase must occur in a context where resources necessary¶ for food production, such as land and water, are even scarcer in a more crowded world, and thus the sector needs to be far more efficient in¶ utilizing productive resources. Further, in the face of global climate change, the world is required to change the ways to conduct economic¶ activities.¶ Fisheries and aquaculture must address many of these diffi cult challenges. Especially with rapidly expanding aquaculture production¶ around the world, there is a large potential of further and rapid increases in fi sh supply—an important source of animal protein for human¶ consumption. During the last three decades, capture fisheries production increased from 69 million to 93 million tons; during the same time,¶ world aquaculture production increased from 5 million to 63 million tons (FishStat). Globally, fi sh2 currently represents about 16.6 percent of¶ animal protein supply and 6.5 percent of all protein for human consumption (FAO 2012). Fish is usually low in saturated fats, carbohydrates,¶ and cholesterol and provides not only high-value protein but also a wide range of essential micronutrients, including various vitamins,¶ minerals, and polyunsaturated omega-3 fatty acids (FAO 2012). Thus, even in small quantities, provision of fi sh can be eff ective in addressing¶ food and nutritional security among the poor and vulnerable populations around the globe.

#### Right now-China has cornered the market on aquaculture and is providing that food for the developing world

Chris **Andrikos, 2013**, “CHINA: The Seafood Empire, *Fishery News*, May 1st, <http://usfishlaw.com/like-in-many-other-industries-china-leads-the-way-in-aquaculture-producing-70-of-all-the-worlds-farmed-fish/>, [accessed May 6th, 2014]

The global superpower of seafood is undoubtedly China. With all fin-fish, crustaceans, and mollusks propagated in the country, there combines a total of 45 Million tons (90 billion pounds) annually, according to the Food & Agriculture Organization (FAO). This number does seem astronomical, but in fact includes ‘extensive’ and ‘intensive’ aquaculture production. While neighboring Asian nations like Japan and Taiwan dominate the ‘intensive’ culture development, China remains top producer utilizing primarily ‘extensive’ culture methods.¶ The term ‘extensive’ culture refers to a scheme using natural lands and waters, low-zero feed inputs, minimal maintenance, and virtually no inputs into the system at all, besides stocking the fish. ‘Intensive’ systems refer to the exact opposite, utilizing high feed, fertilizer, and antibiotic inputs, in-land re-circulating systems with heavy mechanization and filtration. Most of the extensive culture in China is of fresh-water origin with carp as the highest produced species, followed closely by freshwater shrimp and tilapia. With the demise of most capture fisheries in the past century, China has established an aquaculture industry unlike any other on the globe, delivering prosperity, economic growth, and quality aquatic protein to the nation.

**But, this continued Chinese production is unstable-U.S. reform is key to prevent food shocks and insecurity**

John S. Corbin**,** J.D. and President of Aquaculture Planning and Advocacy LLC which offers expertise in aquaculture policy formulation and planning, species and site selection, resource and environmental assessments, permit acquisition, etc., 2010, ALB

In addition to the potentially disruptive¶ factors mentioned above,¶ which are likely to continue for the¶ foreseeable future, there are other important¶ reasons why maintaining U.S.¶ accessibility to adequate seafood¶ imports may be viewed as a “risky¶ proposition” over the long term. Strategically,¶ the important supply question¶ is: Could the adequacy of seafood¶ supplies from imports, in what already¶ is a volatile globalmarketplace, be jeopardized¶ by the anticipated increases in¶ regional competition for product, the¶ growth of mega cities in seafood source¶ regions, China’s dominance in the seafood¶ trade, and the increasing likelihood¶ of unforeseen geopolitical events¶ and disputes? Fishery products are essential commodities¶ for both developing and¶ developed countries, and regional¶ competition for seafood sources can¶ be expected to increase in the decades¶ to come. Per capita aquatic protein¶ consumption globally has been rising¶ the last few decades, with estimates¶ for 2006 at 16.7 kg (35.9 lb). Importantly,¶ fish today provide more than¶ 3 billion people with 15% or more of¶ their annual animal protein consumption¶ (FAO, 2009b).¶ Developing countries in the Asia-¶ Pacific region accounted for approximately¶ 79% of global fishery¶ production in 2006 (capture and culture¶ sources), and this value is expected¶ to increase with time (FAO, 2009b).¶ Japan, the United States, and the European¶ Union are the major markets¶ for their exports, with a significant¶ total market share of 72% of the total¶ 2006 value. With respect to aquaculture¶ production alone, the Asia-Pacific¶ region today produces 90% of the¶ farmed food and 80% of the world¶ value. The region’s dominance as a¶ critical supplier of cultured products¶ is expected to continue well into this¶ century (FAO, 2009b).¶ Several emerging trends in Asia¶ could direct seafood supplies away¶ from the export channels to the United¶ States, that is, create a more competitive¶ regional environment for products.¶ The majority of the world’s population¶ increase in the next 20 years¶ will occur in the Asia-Pacific region,¶ and it is anticipated that the regional¶ cultures at all levels of the economic¶ spectrum will maintain their preferences¶ for seafood; for example, per¶ capita consumption amounts in higher¶ income countries are expected to continue¶ to grow. Rising standards of¶ living, increasing incomes, and diversification¶ of diets in selected parts of the region are expected to maintain and/or¶ expand demand for seafood (FAO,¶ 2009b). To illustrate, Asian countries,¶ other than China, experienced an increase¶ of 5.9 kg (13.0 lb) in per capita¶ consumption between 2003 and 2007¶ (Johnson, 2008).¶

#### Transgenic fish are the best solution-But current FDA oversight fails

Menozzi, Mora, and Merigo, 12 Davide, Researcher of Agrifood Economics, University of Parma, Cristina, University of Parma, and Alberto, University of Parma, “Genetically Modified Salmon for Dinner? Transgenic Salmon Marketing Scenarios,” AgBio Forum, The Journal of Agrobiotechnology Management & Economics, Vo. 15, n. 3, <http://www.agbioforum.org/v15n3/v15n3a04-menozzi.htm>, ALB

Introduction Worldwide fish demand is expected to increase dramatically in the coming years due to population growth and increasing disposable income. Fish farming is becoming an increasingly important player in satisfying demand, especially for high-value species. Accordingly, a rapid increase in aquaculture production has been observed (Food and Agriculture Organization of the United Nations [FAO], 2010). Aquaculture is the fastest-growing food industry in the world, and salmon farming is the fastest-growing sector in global aquaculture (McLeod, Grice, Campbell, & Herleth, 2006). This article describes the future trends in the salmon farming sector and the potential effects of genetically modified (GM) salmon introduction on the salmon industry. We have developed a qualitative scenario analysis based on a literature review and expert consultation to conduct this analysis. Approximately 50 species of fish have been subject to genetic modification, resulting in more than 400 fish/trait combinations (Cowx et al., 2010). Most of the modifications have been carried out on food species, such as Atlantic salmon, tilapia, and common carp. Transgenic fish may offer many advantages for aquaculture, including growth enhancement, improved disease resistance, improved cold tolerance or resistance to freezing, sterility, and altered metabolism to reduce the requirement for fish-based diets in the case of carnivorous fish species (Beardmore & Porter, 2003; Cowx et al., 2010; Maclean, 2003). The biotech company Aqua Bounty Technologies, headquartered in Waltham, Massachusetts (United States), has produced a transgenic Atlantic salmon breed known as AquAdvantage®. The AquAdvantage® salmon is modified using a Chinook salmon growth hormone (GH) gene. In non-GM salmon, GH production decreases during the cold winter months. Using a promoter from an antifreeze gene derived from the ocean pout, the inserted gene is expressed in the cold season. The new promoter thus disrupts the salmon’s normal growth cycle. Essentially, the modification works by making the salmon growth cycle continuous rather than seasonal, as is the case in unaltered varieties. As a result, the fish grows to a marketable size within 18 months instead of 3 years. The process does not produce a bigger fish overall. The feed conversion ratio (FCR)1 is expected to be more efficient (Clifford, 2009; Entis, 1998). Feed consumption is a critical environmental issue for salmon aquaculture: this issue increases pressure on wild fish stocks and results in the allocation of edible fish to feed salmon. Feed consumption is also an economic concern: feed costs are approximately 50-60% of production costs for salmon farmers (Asche, 2008). Thus, GM salmon is expected to provide a sustainable solution both to environmental and economic constraints. Indeed, if each GM salmon substitutes one-for-one for a non-GM farmed salmon, then waste effluent and pressure on wild sources of fish meal and oil would decline because the GM salmon grows faster and requires less feed. However, if GM salmon introduction expands the overall market enough to offset the fish meal and oil input reduction, then the environmental pressure related to wastes and wild stock depletion will intensify because of higher production levels and feed usage (Smith, Asche, Guttormsen, & Wiener, 2010). Improving the salmon FCR is also a critical ethical question because sources of fish meal could be used to improve food security rather than feeding fish (Le Curieux-Belfond, Vandelac, Caron, & Seralini, 2009; Olesen, Myhr, & Rosendal, 2011). The formal application for AquAdvantage® GM salmon approval, first presented by Aqua Bounty in September 1995, successfully passed the 7-additive step of the Food and Drug Administration (FDA) process (Van Eenennaam & Muir, 2011). To address environmental concerns regarding the risk of escape of transgenic salmon, AquaBounty has incorporated multilevel biological and physical containment measures. The company ensures that all AquAdvantage® salmon will be sterile (triploid) and single sex (female). These measures will guarantee that, in the event of escape into the environment, the AquAdvantage® salmon will be unable to reproduce and establish breeding populations and will be incapable of breeding with native fish populations. Moreover, AquaBounty will grow salmon eggs in Canada and juvenile salmon in Panama in a land-based facility with physical confinement barriers (Van Eenennaam & Muir, 2011; Vazquez Salat & Salter, 2011). The FDA also identified two food safety concerns: the effects of the ingestion of GH fish and allergenicity. The FDA dismissed the former concern but found several limitations with the study design presented by the company to address the latter. Thus, the FDA recommended further allergenicity experiments on AquAdvantage® salmon (Van Eenennaam & Muir, 2011; Vazquez Salat & Salter, 2011). Despite these concerns, the growth-enhanced GM salmon could become the first genetically engineered food animal approved for human consumption. However, the FDA failed to account for several market issues. The effects of GM salmon introduction on salmon market price, consumption, production costs, public health, etc., are beyond the scope of the FDA assessment. This article aims to bridge these gaps by providing a discussion of these potential market-related issues. The next section provides a description of the method we have applied. Then, we analyze the salmon industry and the main driving forces of GM salmon introduction. We report the results of the expert consultation and provide a narrative description and validation of the three scenarios. Finally, we discuss the results and present some conclusions.

The best reform is GE technology-Saves the aquaculture industry

Mayekar ’14- Trivest, Research Scholar,Central Institute of Fisheries Education, BIOTECHNOLOGY AND ITS APPLICATIONS IN AQUACULTURE AND FISHERIES¶ 03/04/2014¶

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Introduction Biotechnology provides powerful tools for the sustainable development of aquaculture, fisheries, as well as the food industry. Increased public demand for seafood and decreasing natural marine habitats have encouraged scientists to study ways that biotechnology can increase the production of marine food products, and making aquaculture as a growing field of animal research. Biotechnology allows scientists to identify and combine traits in fish and shellfish to increase productivity and improve quality. Scientists are investigating genes that will increase production of natural fish growth factors as well as the natural defense compounds marine organisms use to fight microbial infections. Modern biotechnology is already making important contributions and poses significant challenges to aquaculture and fisheries development. It perceives that modern biotechnologies should be used as adjuncts to and not as substitutes for conventional technologie s in solving problems, and that their application should be need-driven rather than technology-driven. The use of modern biotechnology to enhance production of aquatic species holds great potential not only to meet demand but also to improve aquaculture. Genetic modification and biotechnology also holds tremendous potential to improve the quality and quantity of fish reared in aquaculture. There is a growing demand for aquaculture; biotechnology can help to meet this demand. As with all biotech-enhanced foods, aquaculture will be strictly regulated before approved for market. Biotech aquaculture also offers environmental benefits. When appropriately integrated with other technologies for the production of food, agricultural products and services, biotechnology can be of significant assistance in meeting the needs of an expanding and increasingly urbanized population in the next millennium. Successful development and application of biotechnology are possible only when a broad research and knowledge base in the biology, variation, breeding, agronomy, physiology, pathology, biochemistry and genetics of the manipulated organism exists. Benefits offered by the new technologies cannot be fulfilled without a continued commitment to basic research. Biotechnological programmes must be fully integrated into a research background and cannot be taken out of context if they are to succeed.

#### GM Fish don’t just improve numbers-They also include product quality-They’re the key internal link to food security and safety

**Muhhamet, et al, 12**- (Altunok,Peker Zerife, Serezli Ramazan, Tekinay Ahmet Adem, Kizak Volkan, Founders of Faculty of Fish, Operate on Izmir Katip Celebi University in İzmir, Turkey, Sustainable development of aquaculture, Biotechnology and Aquaculture in Sustainable Development, <http://eprints.ibu.edu.ba/1243/1/1.%20Biotechnology%20and%20Aquaculture%20in%20Sustainable%20Development.pdf>, DA)

Aquaculture production increases but there is a question remains whether the industry grows in a sustainable manner and fast enough to meet the future projected demand while preserving the natural resources. To cope with this global uncertainity, biotechnology plays a key role in the sustainable development of aquaculture includes economic and social development as well as environmental protection throughout the world. Application of biotechnology to production of aquatic species has great potential to improve aquaculture and to meet demand for aquatic foods. Along with increasing production of aquatic food products, biological techniques should be applied to increase productivity and improve product quality. In parallel, there are several potential key contributions of biotechnology both to increase resistance against diseases and to increase growth rates of aquatic species. Biotechnology contributes to sustainable aquaculture by reducing the dependence on chemicals, particularly antibiotics, through the deployment of genes conferring resistance to diseases. Biotechnology also provides powerful tools for the enhancement and protection of wild and cultured aquatic species, particularly the improvement of fish stocks in commercial aquaculture production. Also, biotechnology allows the production of species in more quantities on the same area (intensification) at a lower cost, the support biodiversity and vital ecosystems, and the reduction of environmentally damaging aquacultural practices.

#### That solves extinction

Richard Lugar, former U.S. Senator and Former Chair, Senate Foreign Relations Committee, 2004, “Plant Power”, Our Planet, 14(3), http://www.unep.org/ourplanet/imgversn/143/lugar.html

In a world confronted by global terrorism, turmoil in the Middle East, burgeoning nuclear threats and other crises, it is easy to lose sight of the long-range challenges. But we do so at our peril. One of the most daunting of them is meeting the world’s need for food and energy in this century. At stake is not only preventing starvation and saving the environment, but also world peace and security. History tells us that states may go to war over access to resources, and that poverty and famine have often bred fanaticism and terrorism. Working to feed the world will minimize factors that contribute to global instability and the proliferation of weapons of mass destruction. With the world population expected to grow from 6 billion people today to 9 billion by mid-century, the demand for affordable food will increase well beyond current international production levels. People in rapidly developing nations will have the means greatly to improve their standard of living and caloric intake. Inevitably, that means eating more meat. This will raise demand for feed grain at the same time that the growing world population will need vastly more basic food to eat. Complicating a solution to this problem is a dynamic that must be better understood in the West: developing countries often use limited arable land to expand cities to house their growing populations. As good land disappears, people destroy timber resources and even rainforests as they try to create more arable land to feed themselves. The long-term environmental consequences could be disastrous for the entire globe. Productivity revolution To meet the expected demand for food over the next 50 years, we in the United States will have to grow roughly three times more food on the land we have. That’s a tall order. My farm in Marion County, Indiana, for example, yields on average 8.3 to 8.6 tonnes of corn per hectare – typical for a farm in central Indiana. To triple our production by 2050, we will have to produce an annual average of 25 tonnes per hectare. Can we possibly boost output that much? Well, it’s been done before. Advances in the use of fertilizer and water, improved machinery and better tilling techniques combined to generate a threefold increase in yields since 1935 – on our farm back then, my dad produced 2.8 to 3 tonnes per hectare. Much US agriculture has seen similar increases. But of course there is no guarantee that we can achieve those results again. Given the urgency of expanding food production to meet world demand, we must invest much more in scientific research and target that money toward projects that promise to have significant national and global impact. For the United States, that will mean a major shift in the way we conduct and fund agricultural science. Fundamental research will generate the innovations that will be necessary to feed the world. The United States can take a leading position in a productivity revolution. And our success at increasing food production may play a decisive humanitarian role in the survival of billions of people and the health of our planet.

### 1AC Plan(s)

<SAMPLE PLANS-FIGURE OUT WHAT THE BEST OPTION FOR YOU IS OR WRITE YOUR OWN>

#### The United States Fish and Wildlife Service should substantially increase its review and approval of transgenic fish applications

#### The United States Federal Government should delegate authority to the United States Fish and Wildlife Service to increase its review of transgenic fish applications

#### The United States Fish and Wildlife Service should establish a regulatory framework for the approval of transgenic fish applications

### 1AC Solvency

#### Fish and Wildlife Service solves best

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

This paper provides an overview of the U.S. regulatory framework governing genetic biocontrol efforts for invasive ﬁsh. Genetic biocontrol refers to the intentional release of genetically modiﬁed organisms (GMOs) into the environment to control a target population of a non-native species. The terms ‘‘genetically modiﬁed’’ and ‘‘genetically engineered’’ are often used interchangeably, despite the scientiﬁc distinctions. A GMO is an organism that has had its genetic material altered or modiﬁed by humans through any method, including conventional breeding. Genetic engineering, as deﬁned by the Food and Drug Administration (FDA), is the use of recombinant DNA techniques to introduce new characteristics or traits into an organism. GE organisms are therefore a subset of GMOs. As this paper will discuss, existing laws focus on GE organisms raising signiﬁcant questions as to whether organisms modiﬁed without utilizing rDNA techniques fall within the jurisdiction of any federal agency. Under the 1986 Coordinated Frame- work for Regulation of Biotechnology, three federal agencies have primary responsibility over biotechnology—the Environmental Protection Agency (EPA), the U.S. Department of Agriculture, and the FDA. Because the EPA has exempted biological control agents from regulation as pesticides and no ﬁsh species are currently considered plant pests, the FDA is the agency responsible for approving the use of genetically engineered ﬁsh for biocontrol. FDA regulates genetically engineered animals through its New Animal Drug Application (NADA) process. The NADA process presents several challenges to effective and transparent regulation of genetic biocontrol, including the FDA’s focus on drug safety, secrecy provisions potentially limiting disclosure of the results of environmental reviews, and the secondary role of the Fish and Wildlife Service, the federal agency with the most experience with invasive species management. In addition, relying on the NADA process creates a signiﬁcant regulatory gap as NADA approval is only required for GE organisms. The regulatory framework for GMOs created for genetic biocontrol without rDNA technology is unclear and primary responsibility may fall to the states. Given its extensive experience with hatcheries, invasive ﬁsh species control, and environmental reviews, the Fish and Wildlife Service (FWS) is the more appropriate agency to review applications for genetic biocontrol. Efforts should be undertaken now, while genetic biocontrol is still in the theoretical stages, to increase the role of the FWS in the permitting process either through formal regulations or more informal mechanisms such as memorandum of understanding.

And, no Das-Only risk of environmental harm is without a proper agency process which the plan solves for

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Although rDNA techniques have yet to leave the laboratory, researchers are exploring whether a trans- genic ﬁsh could be developed that when released would bear a deleterious genetic construct designed to disrupt a speciﬁc aspect of the organism’s life cycle or biology. (Kapuscinski and Patronski 2005). Australian scientists, for example, have investigated whether the common carp could be genetically engineered to produce only male offspring. (Thresher and Bax 2003). In theory, such ‘‘daughterless’’ genes, when introduced into the target invasive species population, would ultimately drive the species to extinction. Although there are established regulatory frame- works in the US for classical biological control, biological control efforts utilizing genetically modiﬁed organisms as the biological control agent will be subject to a complex, still evolving approval process. Further- more, the federal agencies with primary authority over GMO approvals have little to no experience with invasive species management. In addition, the following analysis of the range of biological control options for invasive ﬁsh reveals overlaps and gaps in the federal regulatory framework that open the door for additional regulation by affected states. Without a rigorous and comprehensive review process, there is increased risk that emerging technologies such as genetic biocontrol will be implemented beforethe potential environmental consequences are fully vetted and understood.

## Invasive Species Advantage-Extensions

### Top Level Extension

Invasive species are an increasing threat due to increased Arctic travel-This will be DEVASTATING to biodiversity

Rogers, 6/6 Jillian, The Arctic Sounder, “Invasive species threaten ecosystems in the Arctic,” <http://www.thearcticsounder.com/article/1423invasive_species_threaten_ecosystems_in_the>, ALB

There are millions of stowaways headed for the Arctic. Sea-dwelling organisms that could wreak havoc on Arctic ecosystems are hiding out in and on ships that, more and more, are using shipping routes in the North. A report published last week by Whitman Miller, an ecologist at the Marine Invasions Research Laboratory at the Smithsonian Environmental Research Center, stated that invasive species are destined for the Arctic with the influx of vessels. Melting sea ice has opened routes in the Arctic — the Northwest Passage and the Northern Sea Route — making a quicker path from one side of the world to the other. "The economic draw of the Arctic is enormous," Miller wrote in the report. "Whether it's greater access to the region's rich natural resource reserves or cheaper and faster inter-ocean commercial trade, Arctic shipping will reshape world markets. If unchecked, these activities will vastly alter the exchange of invasive species, especially across the Arctic, north Atlantic and north Pacific oceans." Organisms from ports can cling to the undersides of a ship's hull or hunker down in the large tanks of seawater inside a ship. "Ships are moving over the Arctic and can carry a tremendous number of species in their ballast water ... connecting ports in a way that they have not been connected before," Miller said last week. The danger lies in the likelihood of these critters taking over their new environment and killing off native species. Miller said for the past century or so, ships traveling between oceans got from one to the other by way of the Panama or Suez Canals. Both of those courses offered warm, tropical water, and that temperature stress would often kill or weaken hangers-on. "In the Panama Canal, species on the hulls of ships also had to cope with a sharp change in salinity, from marine to completely fresh water," read the report. "The Arctic passages contain only cold, marine water." As long as species are able to survive cold temperatures, the odds of surviving in the Arctic are good. Water in ballast tanks is used to balance and stabilize ships. Ocean liquid is sucked in and spit out accordingly, organisms and all, depending on the ship's load and conditions. "Typically this is done in coastal waters and in ports where you're offloading or loading cargo, and in doing so, you're not just taking water, you're taking all the biological and planktonic communities with that water," Miller said. "The potential biological cocktail that you can concoct is pretty staggering," Miller said. Ballast tanks on big ships can hold up to about 100,000 metric tons of water, Miller said. And once you start multiplying that by the number of shipping vessels in the water heading north, the amount of water and living organisms exchanged is enormous. When a species arrives in a new environment, they have no established predators, said Gary Freitag, a marine biologist with the Marine Advisory Program in Ketchikan. "They have a tendency to prey on the native species, eat the food of the native species, and take over habitat of the native species," he said. "And in most cases, they're a little more resilient because if they're able to establish in an unfamiliar habitat, they're pretty flexible critters." If left unchecked, invasive species spread rapidly with little course of action because they can be difficult to detect until the damage is done. "We don't quite know what will happen in the Arctic because we haven't experienced invasive species really in the Arctic yet." A few years ago, Freitag traveled to the North Slope to collect data from the waters off Point Barrow. Much of their efforts were stymied by a storm, he said, but he is planning more work in the North. A current threat in other parts of Alaska is the European green crab, a hardy crustacean that can thrive in a variety of climates. A variety of other crabs, and tunicates — the most common called "rock vomit" — are also on the list of invasive species infecting Alaska waters. Some of the most-wanted are found clinging to the ship's hulls, while some ride along in ballast tanks. In one year, around 50 or 60 million metric tons of water comes to the U.S. from overseas via ballast water. In Alaska, between 2009 and 2012, 14 million metric tons of ballast water was discharged annually in ports, said Danielle Verna, a graduate fellow with the Smithsonian Environmental Research center. Verna has been studying invasive species in ballast water for years and has conducted research in Valdez and Cordova. "When you're talking about risk of invasive species in the Arctic, you have to consider the increased vessel traffic," she said. Part of her thesis work looked at various factors that influence risk, such as the age of ballast water, the similarities between the source and where the water is discharged, and the species richness in the source port. "Those are all factors that you would have to consider in an Arctic environment," Verna said.

### Ballast Water=Invasive Species-Extensions

#### Ballast water causes invasive species problems AND no current tech solves

Nahui Zhang, Environmental Engineering Institute, et al [Zhitao Zhang, Mindong Bai, Cao Chen, Xiangying Meng, Yiping Tian], 2012 “Evaluation of the ecotoxicity and biological efficacy of ship ballast water treatment based on hydroxyl radicals technique,” Marine Pollution Bulletin (64) 2012 2742-2748, ScienceDirect

Ballast water discharges have historically been a major source of nonindigenous species introductions to marine ecosystems (Albert et. Al, 2010) and are recognized internationally as vectors for the translocation of invasive marine organisms (GEF-UNDP-IMO GloBallast Partnerships and IOI, 2009; Ruiz et. Al., 1997; Gollasch et. Al, 2000, Carlton, 2013). The International Maritime Organization (IMO) has been actively engaged in seeking a solution to the ballast water problems. The aim of the International Convention for the Control and Management of Ship’s Ballast Water and Sediments, hereinafter referred to as “the Ballast Water Convention” (IMO, 2004), is to reduce the risk of introducing non-native species, and also to enhance protection of the marine environment and biodiversity. Since the adoption of the Convention and more particularly Guidelines G8 for approval of ballast water management systems in 2005, a substantial number of treatment systems have been put into development globally. Many systems do not come to public light until they apply for Basic Approval of Guidelines G9 by the Maritime Environmental Protection Committee (MEPC) (Lloyd’s Register 2013.) ¶ The available technologies for ballast water treatment can generally be summarized as ultraviolent (UV) irradiation, electrolysis, and ozonization. However, no method for ballast water treatment currently in use is completely biologically effective, environmentally safe, or cost-efficient. (Gregg and Hallegraeff, 2007). For example, high efficiency US irradiation depends on low turbidity and high clarity water and unfouled quartz sleeves to achieve good UV transmission through the water (Lloyd’s Register, 2011). For electrolyosis, the efficiency varies according to water conditions (salinity, pH, temperature, etc.) and by-products, especially hydrogen (H2), have a potential risk of explosion onboard (Bai et. Al 2012). Ozonization is especially effective at killing micro-organisms, it can produce bromate and other by-products which may cause adverse environmental impacts (Lloyd’s Register 2011). Therefore, it is important to develop more effective ballast water treatment methods.

#### Ballast water causes huge invasive species problems-And the impact to biodiversity is NOT reversible

Dandu Pughiuc, Head of the Marine Biosafety Section, International Maritime Organisation, 2010, “Invasive species: ballast water battles,” <http://www.imo.org/KnowledgeCentre/PapersAndArticlesByIMOStaff/Documents/Invasive%20species%20by%20DP.pdf>, ALB]

With the introduction of steel-hulled vessels and the use of water as ballast, the problem of invasive species became even more pertinent due to the larger quantities of ballast transported and, implicitly, the increased number of species moved from one place to another. The development of larger and faster ships completing their voyages in ever shorter times, combined with rapidly increasing international trade, meant that the natural barriers to the dispersal of species across the oceans were being reduced. As a result, the spread of invasive species is now recognized as one of the greatest threats to the ecological and economic well being of the planet. These species are causing enormous damage to bio-diversity. The valuable natural riches of our planet, upon which we depend, are under threat. Direct and indirect health effects are becoming increasingly serious and the damage to nature is often irreversible. Aquatic invasions-considered the second greatest threat to global bio-diversity after habitat loss-are virtually irreversible, and increase in severity over time.

#### Invasive species impact of ballast water is empirically proven

Melanie Frazier, Western Ecology Division, National Health and Environmental Effects Research Laboratory, A. Whitman Miller, Smithsonian Environmental Research Center, and Gregory M. Ruiz, Smithsonian Environmental Research Center, 2013, “Linking science and policy to prevent the spread of invasive species from the ballast water of ships,” Ecological Applications, March

Human activities are causing the global redistribution of species at historically unprecedented rates. In marine (and some freshwater) environments, many nonindigenous species are introduced through the ballast water of ocean-going vessels. When ships fill their ballast tanks to compensate for changes in load, vast assemblages of aquatic organisms are collected and subsequently discharged into new ports. In the past century, the rate of species introductions in marine environments has increased due to a growing global shipping fleet, faster and larger ships, and changes in global import and export patterns. The introduction of nonindigenous species is recognized as one of the major environmental stressors of aquatic ecosystems. For example, invasive species such as the European zebra mussel (Dreissena polymorpha) and the western Atlantic comb jelly (Mnemiopsis leidyi) have caused extensive economic and ecological damage in regions outside their native ranges where they have been introduced via ballast water. Concern about the spread of nonindigenous species has prompted efforts by international, U.S. federal and state, and governing bodies outside the United States to manage ballast water discharges.

#### Ballast water causes major invasive species issues

John Flesher, Associated Press, 3/29/2013, “Scientists: Ballast water dumped by ships carries invasive species,” http://news.msn.com/science-technology/scientists-ballast-water-dumped-by-ships-carries-invasive-species

¶ The Environmental Protection Agency has issued new requirements for cleansing ballast water dumped from ships, which scientists believe has provided a pathway to U.S. waters for invasive species that damage ecosystems and cost the economy billions of dollars.¶ ¶ Commercial vessels are equipped with tanks that can hold millions of gallons of water to provide stability in rough seas. But live creatures often lurk in the soupy brews of water, seaweed and sediment. If they survive transoceanic journeys and are released into U.S. waters, they can multiply rapidly, crowding out native species and spreading diseases.¶ ¶ Ships are currently required to dump ballast water 200 miles from a U.S. shoreline. But under the new general permit released Thursday by the EPA, vessels longer than 79 feet — which includes an estimated 60,000 vessels — must also treat ballast water with technology such as ultraviolet light or chemicals to kill at least some of the organisms.

### Ballast Water = Food System I/L

#### Ballast water causes invasive species and food system disruption

Lucie Maranda, Graduate School of Oceanography, University of Rhode Island, et. Al [Annie M. Cox, Robert G. Campbell, and David C. Smith, of the same institution], 2013, “Chlorine dioxide as a treatment for ballast water to control invasive species: Shipboard testing,” Marine Pollution Bulletin 75, 76-89, pg. Science Direct]

Among human-mediated vectors of species introduction into freshwater, estuarine and marine ecosystems, the discharge of foreign ballast water from large ships constitutes a major threat to the integrity of coastal environments (e.g., Carlton and Geller, 1993, Chapman et al., 2012, Drake et al., 2007, Ruiz et al., 2000 and Sala et al., 2000). The globalization of trade, the increased speed and capacity of ocean-going vessels all augment the potential for non-indigenous species to be introduced, to survive, thrive and propagate in receiving coastal waters. The sheer volume of ballast water being transferred around the globe per year is currently estimated at 10 billion metric tons and guaranties that introductions will occur, with some of these becoming deleterious to established food webs, jeopardizing local fisheries, or developing into nuisance species, to name just a few unwanted outcomes (Tamelander et al., 2010). Pimentel et al. (2005) estimated the annual costs associated with losses, damages and control measures resulting from the introduction of aquatic non-indigenous species to be $7.8 billion in the United States alone, although monetary valuation does not solely represent the benefits of functioning ecosystems (Lovell and Drake, 2009 and Rothlisberger et al., 2012).

### Ballast Water=Economic Downfall

#### Ballast water leads to invasive species and economic downfall

Stefan Kecan, Federal Maritime and Hydrographic Agency, 2012, “Overview of Ballast Water Treatment Principles,” 2012, Emerging Risks from Ballast Water Treatment, http://www.bfr.bund.de/cm/350/emerging-risks-from-ballast-water-treatment.pdf

Since wooden ships were replaced with steel-hulled vessels in the second half of the 19th century natural water has been used for ships’ ballast. Water can be easily pumped in and out of ballast tanks. Ships’ ballast is important for stability and trim of a vessel. Ballast (water) remarkably contributes to the safety of ships, crew, and cargo. The centre of buoyancy of a common vessel is way beyond the water level. (The cruise ships Queen Mary II has a draught of about 10 m and is about 40 m high above the water level.) So, a vessel actually would be capsized easily. Ballast is used to tare a vessel like a skip jack. A ship has to upright itself in any possible situation it may encounter. Furthermore, ships’ ballast prevents torsion of a vessel’s hull anddetermines the posture of a ship in the water (Sharma, 2011). The world’s shipping fleet carries billons of tonnes of ballast water each year. Depending on the size and number of ships entering a harbor a huge amount of ballast water might be discharged into the environment. Because of the natural origin of ballast water several living organisms(bacteria, algae, juvenile, adult animals) are highly abundant in this water. By shipping these organisms are distributed all over the world.¶ Ecosystems are a complex and very sensitive network of species interactions, established over long historical periods. Non-indigenous species introduced e.g. by ships’ ballast water, could seriously threaten the biodiversity and stability of such evolved aquatic bionetworks. Beyond that, the invaders could lead to substantial economic consequences. For example, the comb jelly Mnemiopsis leidyi (Agassiz, 1865) was introduced in the Black Sea in the late 1980s. That caused a drastic reduction in zooplankton, ichthoplankton, and zooplanktivorous fish populations in that area. A collapse of local anchovy fishery around the Black Sea ensued from this decline in zooplankton and fish populations (E.g. Kideys, 1994; Shiganova et. Al, 1998, 2001).

### Status Quo Doesn’t Solve

#### International measures don’t solve-Ballast water is still a huge problem

Lucie Maranda, Graduate School of Oceanography, University of Rhode Island, et. Al [Annie M. Cox, Robert G. Campbell, and David C. Smith, of the same institution], 2013, “Chlorine dioxide as a treatment for ballast water to control invasive species: Shipboard testing,” Marine Pollution Bulletin 75, 76-89, pg. Science Direct]

In 2004, the International Maritime Organization (IMO), recognizing the risks and damages associated with alien species introductions by ballast water discharge, mandated performance standards limiting the concentrations of live organisms allowed to be released (regulation D-2) (www.imo.org): (i) fewer than 10 organisms m−3 ⩾50 μm, (ii) fewer than 10 organisms mL−1 between <50 μm and ⩾10 μm, and (iii) fewer than set concentrations for harmful or indicator microorganisms, namely Enterococcus (<100 colonies forming unit (cfu) 100 mL−1), Escherichia coli (<250 cfu 100 mL−1), and Vibrio cholerae, serotypes O1 and O139 (<1 cfu 100 mL−1 or ⩽1 cfu g−1 (wet weight) of organisms of ⩾50 μm in size) ( IMO, 2009). Although the required minimum number (30) of signatory countries has been surpassed, the tonnage criterion has not yet been met to ensure ratification of the convention; as of January 31th 2013, ∼29% of world shipping tonnage has been reached out of the necessary 35% ( IMO, 2013). In the United States, the Coast Guard is charged with enforcing the 2008 Vessel General Permit (VGP) regulations to prevent the spread of aquatic nuisance species (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm; Anonymous, 2012). The VGP is currently regulated by the Environmental Protection Agency (EPA); it will be replaced in late 2013 for the next five years by the Final 2013 VGP. Although the U.S. has not yet signed the IMO ballast water management convention, both the U.S. Coast Guard and EPA follow IMO D-2 standards for living organisms to be discharged from ballast water, with the exception of the IMO cholera standard in zooplankton.

#### Ballast water is still a huge problem-Biocide development is necessary

Lucie Maranda, Graduate School of Oceanography, University of Rhode Island, et. Al [Annie M. Cox, Robert G. Campbell, and David C. Smith, of the same institution], 2013, “Chlorine dioxide as a treatment for ballast water to control invasive species: Shipboard testing,” Marine Pollution Bulletin 75, 76-89, pg. Science Direct]

Despite significant efforts in the past decade, there still is a need to find effective, environmentally sound, but also practical and affordable measures to manage and/or treat ballast water in order to curb the spread of potentially harmful species introduction. One approach to treating ballast water is the use of a biocide. Not only must the biocide be effective for a broad range of species and biomass, it must also be safe for use aboard a ship, and must degrade or be neutralized to a non-harmful entity by the time of the ballast water discharge in order to protect local species. One such biocide, chlorine dioxide (ClO2), is a strong oxidant gas with a highly effective antimicrobial activity; it readily dissolves in water and is commonly used as a disinfectant in drinking water and in various industrial applications. It appears to be safe for use aboard ships as the effects of ClO2-treated seawater on metal corrosion were found to be no different from the effects of seawater alone for concentrations up to 10 mg L−1 (D.G. Simpson, personal communication). Furthermore, initial bench-scale testing of ClO2-treated seawater demonstrated that ballast water would be safe for discharge (i.e., ⩽200 μg L−1, the instantaneous maximum limit for residual ClO2 discharge (2013 VGP)) within 24 h of treatment in warm waters (>20 °C), but could necessitate up to 48 h at temperatures close to the freezing point, irrespective of other conditions (Oviatt et al., 2003; M. Hasson, Ecochlor, Inc., personal communication). By reacting with organic compounds, ClO2 does not form deleterious halogenated byproducts, as chlorine does; its main degradation species are the chloride (Cl−) and chlorite View the MathML source ions and sometimes chlorate View the MathML source (Baribeau et al., 2002 and Simpson, 1999).

#### Current U.S. law solves

#### Ryan J. Albert, John M. Lishman, and Juhi R. Saxena, all of the U.S. Environmental Protection Agency, Office of Water, 2013, “Ballast water regulations and the move toward concentration-based numeric discharge limits,” Ecological Applications, Vol. 23 Issue 2

United States federal regulation .— At the U.S. federal level, ballast water management is principally addressed by two statutes: (1) the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990, as amended (16 U.S. Code [U.S.C.] §§ 4701 et seq.); and (2) the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act or CWA, 33 U.S.C. §§ 1251 et seq.; see Fig. 1). Both NANPCA and the CWA preserve the authority of the individual U.S. states to more stringently regulate ballast water discharges that occur in their waters (16 U.S.C. § 4725, NANPCA; 33 U.S.C. § 1370, CWA). For the states that currently regulate ballast water discharges, there is substantial variation in their requirements (Table 1).¶ Congress enacted NANPCA in November 1990 (Public Law 101-646; 104 STAT 4761) to authorize the U.S. Coast Guard (USCG) to issue regulations to prevent the introduction and spread of ANS into the Great Lakes through the ballast water of vessels. In 1996, Congress enacted the National Invasive Species Act (NISA), which amended and reauthorized NANPCA (Public Law 104-332; 110 STAT 4073). Among other things, the amendments made by NISA directed the USCG to develop a national ballast water management program for U.S. waters besides the Great Lakes.

### A2 Mid Ocean Exchange Solves

#### Mid-ocean exchange doesn’t solve ballast water invasive species issues

Jennica M. Seiden and Richard B. Rivkin, both of the Department of Ocean Sciences, Memorial University of Newfoundland, St. Johns, 2014, “Biological controls on bacterial populations in ballast water during ocean transit,” Marine Pollution Bulletin 78 7-14, pg. Science Direct

Mid-ocean exchange (MOE) of ballast water is used to control the introduction of aquatic invasive species. MOE is a process where ships exchange coastal ballast water for oceanic water at least 200 nautical miles offshore and where ocean depths are at least 2000 m (Transport Transport Canada, 2007 and International Marine Organization (IMO), 2008). When MOE is conducted in compliance with IMO guidelines, it is supposed to be effective at reducing the initial concentration of some planktonic organisms by up to 80–95% (Ruiz and Reid, 2007).¶ Recent studies have reported the presence of heterotrophic microbes, such as bacteria and viruses, (Ruiz et al., 2000, Drake et al., 2002, Burkholder et al., 2007, Ma et al., 2009, Seiden et al., 2010, Sun et al., 2010, Leichsenring and Lawrence, 2011 and Altug et al., 2012). Heterotrophic prokaryotes numerically dominate ballast water biota and under some circumstances can be a potential environmental and human health risk (Rigby et al., 1999, Burkholder et al., 2007 and Altug et al., 2012). For example, pathogenic bacteria such as Vibrio cholerae and Escherichia coli can be transported in ballast water and be introduced into previously uncontaminated areas. Additionally, bacteria have characteristics that optimize successful establishment in new environments. They are capable of enduring the harsh conditions in ballast tanks as spores or other resting stages, and because of their high intrinsic growth rates, bacteria can potentially establish high population levels ( Ruiz et al., 2000 and Gregg and Hallegraeff, 2007). Mid-ocean exchange may not be effective in reducing the total number of bacteria in ballast water since open-ocean bacterial abundances are 0.5–1.0 × 109 cells/L, which is quantitatively similar to that in coastal and other near shore regions ( Ducklow, 2000). The propagule pressure of heterotrophic microbes, in particular bacteria and viruses, is orders of magnitude higher than other organisms ( Ruiz et al., 2000, Drake et al., 2002, Drake et al., 2007 and Quilez-Badia et al., 2007).

### Current Legislation Fails

Legislation fails now-EPA isn’t stringent enough

John Flesher, Associated Press, 3/29/2013, “Scientists: Ballast water dumped by ships carries invasive species,” http://news.msn.com/science-technology/scientists-ballast-water-dumped-by-ships-carries-invasive-species

"The numeric limitations in today's permit represent the most stringent standards" that ballast water treatment systems can "safely, effectively, credibly, and reliably meet," the EPA said in a statement with the 200-page report it released on the permit late Thursday.¶ But environmental groups, whose lawsuits forced the EPA to adopt ballast discharge standards in the first place, said they're too weak.¶ "The EPA had an opportunity to lead the world in solving this globally dangerous problem, but they have missed the mark ... again," said Mary Ellen Ashe, executive director of Great Lakes United.¶ She also criticized the EPA for exempting ships that never leave the Great Lakes, where ballast water is blamed for introducing invasive species including zebra and quagga mussels. Those organisms have spread across the lakes, clogging water intake pipes and unraveling food webs by gobbling microscopic plankton on which fish depend.¶ Environmentalists contend that those exempted ships can carry exotic species around the lakes even if they weren't responsible for bringing them to the U.S. The EPA said treatment technologies are "unavailable and economically unfeasible" for those vessels. But it said any built before 2009 would have to take other steps such as limiting the amount of ballast water they pick up near shore.

### Disease

#### Ballast water causes major disease outbreaks

CK Takahashi, Sao Paulo State University, et. Al, 2008, “Ballast Water: A Review of the Impact on the World Public Health,” Journal of Venomous Animals and Toxins including Tropical Diseases, http://www.scielo.br/scielo.php?pid=S1678-91992008000300002&script=sci\_arttext

Since the nineteenth century ships have been using ballast water (BW) for safety, stability, propulsion and maneuverability, as well as to redress loss of fuel weight and water consumption, and to maintain structural stress at acceptable levels. Ballast water has been spreading many non-native species around the globe, but little is known about the extent and potential significance of ship-mediated transfer of microorganisms. The global movements of ballast water by ships create a long-distance dispersal mechanism for human pathogens that may be important in the worldwide distribution of microorganisms, as well as for the epidemiology of waterborne diseases. Only a few studies have been carried out on this subject, most of them involving ballast water containing crustacean larvae and phytoplankton. Specialized microbiological studies on these waters are necessary to avoid a repeat of what happened in 1991, when epidemic cholera was reported in Peru and rapidly spread through Latin America and Mexico. In July of 1992, Vibrio cholerae was found in the USA and the Food and Drug Administration (FDA) determined that it came from ballast water of ships whose last port of call was in South America. In Brazil, just a few studies about the subject have been performed. An exploratory study by the Brazilian National Health Surveillance Agency (Agência Nacional de Vigilância Sanitária – ANVISA) found in ballast water different microorganisms, such as fecal coliforms, Escherichia coli, Enterococcus faecalis, Clostridium perfringens, coliphages, Vibrio cholerae O1 and Vibrio cholerae non-O1. Until now, Brazil has been focusing only on organisms transported to its territory from other countries by ballast water, to avoid their establishment and dissemination in Brazilian areas. Studies that can assess the probability that water ballast carries pathogenic microorganisms are extremely important, as is the examination of ships that arrive in the country. Treatment of the human infections caused by BW exists but none is completely safe and efficient.

#### Ballast water disease outbreaks empirically proven

CK Takahashi, Sao Paulo State University, et. Al, 2008, “Ballast Water: A Review of the Impact on the World Public Health,” Journal of Venomous Animals and Toxins including Tropical Diseases, http://www.scielo.br/scielo.php?pid=S1678-91992008000300002&script=sci\_arttext

BACTERIA¶ Possibly, the least studied aspect of marine bioinvasions is the transfer of nonindigenous microorganisms (10, 18). Commercial ships have spread them around the globe, but little is known about the extension and significance of this transference. The global movement of BW creates a dispersal mechanism for worldwide long-distance distribution of human pathogens, which consequently increases the number of waterborne diseases, affecting humans, plants and other animals (35, 37).¶ The concern about the transmission of potentially pathogenic bacteria via BW began in 1992, when the Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC) of the USA detected Vibrio cholerae in shellfishes collected from ballast tanks of many ships that had come from South America. The water samples investigated showed salinities of 12, 13, 14, 20 and 32 ppm, which indicates that the microorganism is capable of surviving in both estuarine and marine waters (28).¶ A study carried out by Delille and Delille (10) found the presence of enteric bacteria even in Antarctic ice. In January of 1991, a cholera outbreak was first detected in Peru and in September of the same year, it quickly dispersed throughout South America and Mexico. In June of 1992, the microorganism was detected in the USA after tests performed on the BW of several South American ships (28). Delille and Dellile (10) also mentioned that a cholera outbreak that had begun in Indonesia in 1961 had completed its global cycle in 1991 and that the same infection was introduced in the 1990s in Latin America by sea traffic.

### A2 Risk/Invasive Species Turn

#### Risk is low and GM fish genes and breeding can be controlled.

Muir '04 (William Muir, Professor of Animal Sciences at Purdue University, National Center for Biotechnology Information, "The Threats and Benefits of GM Fish," http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1299107/, ST)

In the specific case of GM fish, juvenile viability describes the ability of young transgenic fish to reach adulthood and reproductive age (Fig 2A). Modifications to increase disease resistance would clearly influence this factor, as would transgenes that increase nutrient use, such as phytase, or cause an increase in environmental tolerance against cold, heat or salinity. A transgene, such as a growth hormone gene, that lowers the age of sexual maturity would also be a crucial factor for population expansion. Fish that reach maturity faster will expand in number more rapidly over the course of several generations (Fig 2B). Another important factor is mating success or sexual selection, which is often stronger than viability. If GM males are more attractive to wild-type females, then the prospects for a Trojan gene increase (Fig 2C). In nature, the ability to mate is a much more important force in evolution than Darwin's survival of the fittest. What good does it do for the species to survive to sexual maturity if it cannot then pass on its genes? Relative fecundity—the number of eggs produced by female fish and the number, mobility and survival chances of sperm produced by males—determines the number of offspring per mating pair (Fig 2D). Finally, adult viability describes how often a mating pair can repeat the mating process, again producing more offspring per individual (Fig 2E). These factors are interconnected and even if one of them is low, GM fish could still harm wild populations. If, for instance, juvenile viability is low but mating success is high, GM fish—if they survive to reproductive age—would still be able to spread the transgene among wild-type fish and thus lower the survival chances of both populations (Muir & Howard, 1999). Net fitness components for risk assessment. (A) All impacts of genetic modification on physiology and survival rate can be simply measured as the proportion of juvenile fish surviving to sexual maturity. (B) Age at sexual maturity determines the number ... If such an assessment finds that the probability of transgene spread in the wild population is high, then our efforts should concentrate on biological methods to contain the transgene, such as by using sterile fish. It would also give regulators some idea of whether all transgenic fish should be tested for sterility or only samples, and how large these samples should be. The 2004 NRC report on Biological Confinement of Genetically Engineered Organisms remarks that “the net fitness method (Muir & Howard, 2001; Howard et al, 2004) provid means to estimate—in a secure setting—the probability of severity of the harmful consequences from such transgenic spread. This estimate would help decision makers determine whether to screen all or only a subsample of the population lot” (NRC, 2004). Alternatively, the method could also be used to manage risk when designing GM organisms. By answering the question “What aspects of the life history of the organism result in spread of the transgene?” scientists can devise measures to change or mitigate them. However, our model has its limitations. In its current form, it is deterministic; that is, the input parameters absolutely determine the predictions. Two workshops convened by Information Systems for Biotechnology (www.isb.vt.edu), a biological impact assessment programme managed by the US Department of Agriculture, discussed the model and made two main recommendations to improve it (Hallermann, 2002; ISB, 2004). It should incorporate stochasticity to include random effects, such as failure to mate or gene swamping if a large number of domesticated fish escape into a relatively small natural gene pool. Furthermore, the model predictions should reflect any uncertainty in both the fitness estimates and the outcome of natural selection. By allowing regulators to define and use a consistent set of criteria, our model could provide a general way of evaluating GM animals as part of a standard risk-assessment procedure Another problem with estimating fitness components is the genetic background. If the transgene is inserted next to polymorphic genes that have an impact on fitness in some way, the joint effect of these genes must be considered. Because transgenes are usually inserted into domesticated animals, which are poorly adapted to natural environments, the transgene will probably be linked to maladaptive genes under natural conditions. Although linkage effects between the transgene and other genes disappear over time through recombination, they are high in the short term and present a true challenge for net fitness estimates. Such problems could be addressed by crossing GM fish into a wild background and randomly mating for a few generations to dissipate linkage effects before estimating fitness components. Finally, our approach does not eliminate the need to assess for other events, such as natural disaster or human error. But such catastrophes are rare and cannot be demonstrated on normal timescales. The emphasis must therefore remain on cautious predictions of transgene spread as a first step in risk assessment. To relate this to the analogy of 'Trojan horse' genes that may seep into wild populations, we can take the horse apart and examine it before we take it in; that is, before we allow the commercial use of GM fish. Risk assessment for transgenic organisms has become an increasingly important tool for regulators and policymakers to ascertain potential environmental harm and draft prevention measures. By allowing regulators to define and use a consistent set of criteria, our model could provide a general way of evaluating GM animals as part of a standard risk-assessment procedure. In light of the overall resistance against GM organisms in general, such a generalized model, if widely accepted by regulators and scientists, could make the risk-assessment process more streamlined and effective and allow regulators to address specific concerns. Furthermore, as the political fight over the approval and regulations of GM crops has shown (Moore, 2003), a widely accepted risk-assessment model for regulators could prevent or solve trade conflicts over the use and marketing of foods made from GM organisms. Improving risk-assessment procedures would also help to ensure public trust in this potentially beneficial technology, something that is sorely needed to counter the concern and growing resistance against GM organisms in Europe and the USA. Given the declining stocks of wild fish worldwide and the increasing stress on natural resources, GM fish should not be dismissed so easily.

### Squo Doesn’t Solve-Extensions

#### Other solutions don’t solve-And funding isn’t enough now

Jenkins ’07- Peter T. Jenkins is an attorney and policy analyst at the International Center for Technology Assessment in Washington, D.C. “Paying for Protection of Invasive Species” http://www.issues.org/19.1/jenkins.htm

The introduction of harmful, non-native, invasive species--terrestrial and aquatic--has received heightened recognition because of the threats this form of "biological pollution" poses to ecosystem health, endangered species, economic interests, and even public health. Much of the incalculably valuable native biological diversity of North America eventually could be virtually replaced by aggressive invaders, as already has occurred across large areas of Hawaii and other vulnerable islands. Nevertheless, government funding for responding to this threat remains woefully inadequate. And despite the widespread and massive effects of invasive species, the industries that cause the majority of the problems have resisted tougher policies.¶ Confronted with the need to have funds available in the event of an oil spill, the government decided to levy a fee on all oil shipments to raise revenue for an emergency fund. A similar approach could work to create a fund to pay for rapid response to biological pollution problems, or better yet to prevent them in the first place. Concerted action by the National Invasive Species Council (NISC), the administration, and Congress can make dramatic policy improvements, just as dramatic improvements were made in the nation's oil spill response capabilities.¶ A key reason for the continuing parade of horror stories about invasive species is that when a new unwanted release occurs and is detected, the responsible federal and state agencies typically must scramble for money while the invader is spreading into new territory. Despite a well-meaning executive order and a glossy management plan, "too little, too late" reactions are too common. The General Accounting Office's 2001 report Invasive Species--Obstacles Hinder Federal Rapid Response to Growing Threat, includes these points from the agencies involved: "A major theme running throughout their comments was the impact of inadequate resources on the ability of agencies to respond to new infestations . . . Officials from USDA, Interior, Commerce, and Defense have reported that many rapid response needs have not been and are not being adequately met. Many unmet needs stem from inadequate resources or attention to the problem . . . Agencies' inability to fund accelerated research on emerging threats has limited the availability of effective control methods."¶ Outside experts say the same. A highly respected marine biologist, Jim Carlton of Williams College, in a special report for the Pew Oceans Commission, Introduced Species in U.S. Coastal Waters, concludes with a plea for a $50 million annual increase in federal expenditures on marine aquatic invaders. Further, he proposes: "Industries that play a fundamental role as vectors transporting non-native species should bear more of the costs of prevention, control, and research. Congress should establish a national bioinvasions reparation fee, which will significantly help to recoup federal-funding costs for management, research, and development programs." Similarly, the landmark report Safeguarding America's Plant Resources, prepared by the National Plant Board, which represents the agricultural, nursery, forestry, and other plant industries, calls for $50 million in additional funding to prevent and control invasive plant pest

### Ext’n-Invasive Species = K2 Biodiversity

#### **Invasive Species are the second greatest threat next to global warming**

Cardwell, 13- (Mark, winner of National Newspaper Awards, winner of Kenneth R. Wilson Memorial Award, professional freelance journalist, writer in Quebec, educated at Laval University, University of Toronto, and Midland Secondary School, Midland, Ontario, written for The National Post, Canadian press, and the Montreal Gazette, April 20, 'Global swarming' hits close to home; Invasive alien species, like the Asian clam, emerald ash borer and purple loosestrife plant, are the second greatest threat to biodiversity on Earth - after climate change - and are arriving on our shores with increasing frequency, biologists warn’, The Gazette, Lexis Nexis, DA)

Since he was a kid growing up in the southwest part of the island of Montreal, McGill University biology professor Anthony Ricciardi has enjoyed exploring the shorelines and shallower waters of the Lachine Canal, the St. Lawrence River and Lake St. Louis in search of aquatic wildlife. He frequently finds specimens of exotic native species like sharp-toothed Bowfins, large leeches, big salamanders called mud puppies, and giant insect-and frog-eating fisher spiders. "I've seen fisher spiders in Baie d'Urfé as big as the palm of my hand," Ricciardi said. These days, however, he said he is more likely to find non-native species that arrived only a few years ago, but which live and flourish in the waters around the island of Montreal. They include zebra and quagga mussels, the round goby and Bryozoa - gelatinous, invertebrate moss animals that stick to and form huge colonies on rocks, docks and other submerged objects. "These invaders are everywhere you look," said Ric-ciardi, an invasive species specialist with the Redpath Museum and the McGill School of the Environment, where he is the associate director of research. "Many rivers in Quebec are teeming with them." He and his students are doing research on one of the newest inhabitants of the St. Lawrence - the Asian clam. Considered one of the world's most invasive aquatic species, the clams were discovered in 2009 living in heated waters downstream from the Gentilly nuclear power plant near Bécancour. Because the plant stopped operating after 29 years in December, the McGill researchers are trying to determine if the clams survived the winter without the benefit of manmade heat. The study is one of many scientific initiatives that are being carried out across Canada in an effort to analyze, assess, stop, control and/or eradicate non-native plants and animals. Once introduced to new habitats outside their natural ranges, non-native species can disrupt entire ecosystems by acting as predators, competitors, parasites and hybridizers of native and domesticated plants, animals and marine life. Invasive alien species (IAS) are considered by the International Union for Conservation of Nature to be the second greatest threat to biodiversity on Earth, after climate change. Various sources estimate the global price of IAS, in terms of direct losses, control costs, increased production costs and lost market access, to be $1.4 trillion a year - or roughly 5 per cent of total commerce. The annual cost of IAS in Canada is estimated to be as high as $20 billion in the forestry sector, $7 billion in the Great Lakes region and $2.2 billion in the agricultural sector. Since 2004, when the federal government introduced An Invasive Alien Species Strategy for Canada, federal, provincial and territorial departments and agencies, as well as non-government groups and university-based research groups, work collaboratively to monitor, prevent and/or manage IAS through regulatory, legislative and scientific responses. Environment Canada is the lead federal body for invasive animal species, the Department of Fisheries and Oceans for aquatic issues, Natural Resources Canada for forest pests, and the Canadian Food Inspection Agency for inva-e sive plants. The federal government funds their IAS activities to the tune of $20 million annually. According to the latest federal report on IAS, which was published in 2008, there are 486 invasive plant species across Canada, more than 400 of which are found in the Great Lakes-St. Lawrence River Basin. Plants also account for about 60 per cent of the 163 non-native aquatic species that have been introduced into the Great Lakes during the past 200 years. The other 40 per cent are fish and invertebrates. "(IAS) can cause irreversible damage to our environment," said Wendy Asbil, national manager of the IAS and domestic plant health programs section at the Canadian Food Inspection Agency (CFIA). The IAS program's mandate is to identify, assess and mitigate the risks IAS pose to Canada's plant resource base, particularly the food supply and ecosystems. According to Asbil, invasive plants and weeds pose a variety of problems for everyone from farmers and ranchers to horticulturalists and hunters. "They can choke out natural plants or degrade pasture land or wetlands or compete against agronomic or ornamental desired plants," she said. "That can affect tilling practices or lead to increased use of herbicides and other agents (and) harm ecosystems and the environment." She pointed to purple loosestrife as one well known and destructive IAS. An attractive European plant that is believed to have been intentionally introduced to North America during colonial times, it flourishes across Central Canada. Like other hugely successful IAS such as the common earthworm, the Norway rat and, more recently, zebra and quagga mussels, purple loosestrife lacks natural enemies here and has high reproduction rates. A single plant, for example, can produce 3 million seeds. It grows thickly in ditches, irrigation canals, marshes and even standing water throughout the St. Lawrence River Valley. "It notably dries out and changes wetlands, which are important for so many reasons," Asbil said. However, it is far from the only IAS plant that she and her colleagues are worried about. She named Patterson's Curse (a pasture-degrading cousin of wild parsnip that can be toxic to humans and animals), yellow star-thistle, common crupina, Silverleaf nightshade and devil's tail tearthumb (an invasive vine that forms tangled mats over other vegetation) as other IAS plant threats. Other Canadian researchers, she added, monitor threats to grains, oil seeds and other food and feed products from foreign bacteria and fungi. One such threat is Dutch elm disease, which is spreading to the Canadian Prairies after decimating once-abundant native populations of stately elms across much of North America during the past century. The vector or carrier of the disease is the elm bark beetle. There are two species of the insect - one native and one not. To be sure, alien insects can and do spell big trouble for Canada's vast forests. In Quebec, the emerald ash borer is considered one of the newest and most destructive IAS pests. First found in Windsor, Ont., in 2002 (an introduction blamed on infested wood pallets from China), the green beetles plant their eggs on the inner bark of ash trees. Once hatched, the larvae burrow into and feed on the tree's living tissue. When they emerge as young beetles, they feed on the leaves, causing further damage and killing the host tree within only a few years. They were discovered on the island of Montreal for the first time last summer, and are expected to reach Quebec City this year. Ash trees are hardwoods that grow abundantly along the banks of rivers across southern Quebec, helping to stop erosion and providing crucial shade for fish, animals and some species of plants. As the lead federal agency, the CFIA is working with the province and municipalities in an effort to detect and control the spread of the emerald ash borer through a variety of methods. Instead of tree removal - an approach that was heralded last week in Ontario as helping to eradicate the Asian long-horned beetle, an invasive species that kills broadleaf trees like maple, birch and elm - the CFIA said the restricted movement of ash materials and firewood is the best defence. Private landscaping companies also offer municipalities and homeowners natural and chemical treatments for their ash trees. "It's a big problem," said Conrad Cloutier, an entomologist and biology professor at Université Laval, where he does research on insects - both native and invasive - that interact with plants. "It's very difficult to control invasive species once they establish themselves." A prime example, he added, is the Asian lady beetle. Introduced in many parts of North America as a natural biological control agent for aphids, they have displaced native species and swarm homes and buildings in the fall to prepare to overwinter, causing allergy and other problems for residents. Cloutier is hoping to get $50,000 in government funding for a three-year research project he hopes to begin this summer on a new and emerging IAS insect threat in Quebec - the spotted-wing drosophila. Introduced to the West Coast from Asia a decade ago, the tiny fruit flies lay eggs in mature fruits with high sugar content, notably strawberries, raspberries and blueberries. "This is a major concern to producers here," Cloutier said. "We need to know if they can survive our winters, especially in the Lac St. Jean area. If they can, producers might have to start using pesticides, which no one wants to see happen." For Cloutier, the key to stopping the spread of invasive species is making every effort to stop them from being introduced in the first place. "The risk of introduction of new species is a constant threat today and it's growing with the increase in international trade and the movement of people and goods," he said. "However I don't believe we are doing enough to deal with the problem. "We tend to just follow the lead of other governments, particularly the U.S. But we need to take more control measures and do a lot more research if we hope to understand and control the very real and serious threats we face from invasive species." Ricciardi agreed. And he pointed the finger at world trade - and ocean-going ships in particular, which carry about 90 per cent of all internationally traded goods - as the main source of the problem. "Ships are like massive syringes," he said. "Consider this: a litre of ballast water typically contains hundreds of zooplankton, thousands of algal cells, millions of bacteria, and billions of viruses." The round goby has become one of the most abundant bottom-dwelling fish in the St. Lawrence, Ricciardi said, while zebra and quagga mussels are waging a turf war for dominance in the waters around Montreal. He also pointed the blame at ships for the introduction of Viral Hemorrhagic Septicemia, a deadly infectious fish disease, for the recent mass die-offs of fish and marine birds in the Great Lakes-St. Lawrence River Basin. But he also blamed food markets and the pet trade for the introduction of thousands of species to new regions where they could never make it on their own. "The rate and scale of this phenomenon are unprecedented," said Ricciardi, a scientific committee member of the Canadian Aquatic Invasive Species Network. "It is a kind of human-driven global change that I call global swarming." Some of the most destructive examples, he added, are Burmese pythons in Florida's Everglades, Cane toads in Australia and Asian carp in the Mississippi River system. A large and voracious fish that dominates any ecosystem it enters, the Asian carp threatens to enter Great Lakes-St. Lawrence waters, which are by far the world's largest freshwater fishery. "It's only a matter of time before they're here - in fact they already are," Ricciardi said. Though the fish are strictly banned in Canada, Ricciardi said he was able to buy a live one recently at a fish market in Montreal's Chinatown district, which is just a short walk from the port and the waters of the St. Lawrence. Though he lauds beneficial changes like the new "swish and spit" ballast exchange practice - in which ships exchange their ballast water with salt water while at sea before entering the St. Lawrence - Ricciardi said governments should tackle IAS with the same vigour they do oil spills or national security. "Even if most introduced species are not significantly harmful," he said, "the few that seriously affect our ecosystems, economy and health are reason enough to try to control the vectors that are bringing them here with increasing frequency."

### Invasive Species Impact Extensions-Other

**Invasive species cause extinction**

Miguel **Clavero** and Emili **Garcı´a-Berthou 05**, Institute of Aquatic Ecology, University of Girona, “Invasive species are a leading cause of animal extinctions” <http://200.46.218.171/bds-cbc/sites/default/files/TREE05.pdf>, AY

In a recent Opinion article in TREE, Gurevitch and¶ Padilla concluded that the importance of invasive species¶ in causing declines and extinctions of species is unproven.¶ They analyzed the IUCN Red List database and stated¶ that only 6% of the taxa are threatened with extinction¶ as a result of invasion by alien species and ¶ (ten terrestrial plants and no animal species) of the 762¶ extinctions were the result of the introduction of alien¶ species. We believe that these ﬁgures and the message of¶ the article are misleading.¶ The IUCN database includes a searchable hierarchical¶ classiﬁcation of threats to wildlife (e.g. habitat loss,¶ invasive alien species, harvesting, and so on), which was¶ used by Gurevitch and Padilla in their article.¶ However, this classiﬁcation system is used in only 5.1%¶ (39 out of 762) of the extinct species (e.g. there are 129¶ extinct species of birds, but none of them has been¶ assigned a extinction cause, despite the fact that many¶ are among the best documented cases of extinction) and¶ detailed information about the causes of extinction is¶ provided in other ﬁelds of the database (e.g. the robust¶ white-eye Zosterops strenuus, endemic to Lord Howe Island, Australia, ‘was common before 1918, but plummeted to extinction following the arrival of black rat’). We reanalyzed the extinctions included in the ICUN Read List database on a species-by-species basis and reassessed the role of invasive species in those extinctions. The conclusion is radically different from that reached by Gurevitch and Padilla. Of the 680 extinct animal species, causes could be compiled for 170 (25%), of which 91 (54%) included the effects of invasive speices. For 34 cases (20%), invasive species were the only cited cause of extinction. Habitat destruction and harvesting (hunting and/or gathering) were cited for 82 and 77 species, respectively. Our results agree with those of recent statistical analyses, modeling of future scenarios, and several review of particular taxes by expert groups that have concluded that invasive species are the leading cause of extinction of birds and the second cause of the extinction of North American fish, world fish, and mammals. Although extinction is often the end result of invasions, there are other ecological and evolutionary impacts of biotic homogenization that are less understood, thus prevention and the precautionary principle are of particular relevance to invasive species.

**Bad outweighs the good-economic costs**

**USFS ‘13** United States Forest Service, “Invasive Species” <http://www.fs.fed.us/pnw/invasives/>, AY

In addition to their negative effects, some invasive species may have positive traits. These traits are often the reason a species that eventually becomes invasive was introduced to an ecosystem in the first place. In addition to growing rapidly and crowding out native plants in the region, the Himalayan blackberry, for example, produces edible berries that are relished by wildlife and people alike.

Similarly, though it now threatens to crowd out native plants and increase fire danger, scotch broom, with its bright yellow flowers, was originally planted for beautification and landscaping purposes.

Any positive effect an invasive species might have in an ecosystem can easily be outweighed by the damage it causes. According to the National Invasive Species Information Center, some estimates put the economic cost associated with invasive species damage and control efforts at more than $100 billion a year in the United States.

### Key GBC Definitional Card

#### Important info….More FYI

Gilna, Kusma, and Showalter Otts, 13 Ben, Fenner School of Environment and Society, Australian National University, GenOk, Jennifer, Humphrey School of Public Affairs, University of Minnesota, and Stephanie, National Sea Grant Law Center, University of Mississippi School of Law, “Governance of genetic biocontrol technologies for invasive fish,” *Biological Invasions*, Springer Science, ALB

GBC involves the rational and intentional manipulation of a biological agent at a genetic level in order to improve its characteristics for the control of unwanted or invasive species. GBC is applied but not restricted to the classical model of biological control, in which an unmodified predator, parasite or pathogen is sought to reduce target populations. However, GBC draws on a palette of techniques to modify the biological agent, including the invasive organism itself. GBC opens up a variety of opportunities to intervene in processes of reproduction as well as disease and predation (i.e., a modified pest becomes a biocontrol agent against its unmodified brethren), enabling a diversity of strategies to control unwanted populations. GBC already has been controversially field tested for mosquito control (Benedict et al. 2011; Enserink 2010; Harris et al. 2011; Ostera and Gostin 2011), and several projects in a variety of species have been underway for some years (Angulo and Gilna 2008b). GBC is not limited to genetically engineered agents. It can include chromosomal manipulations (e.g., Trojan Y; Cotton and Wedekind 2007; Gutierrez and Teem 2006) and sterility by triploidy (Zajicek et al. 2011) or selection (Henry et al. 2010; Lozier et al. 2008). In this volume (Thresher et al. in review), the technological options for GBC are reviewed. Kapuscinski and Patronski (2005) also describe and review GBC approaches for invasive fish. Broadly, GBC includes any rational modification of the agent in a heritable manner or that exploits our genetic understanding of heritability in order to halt reproduction or drive the unwanted population down in other ways: for example, autocidal strategies by genetic engineering (Fryxell and Miller 1995; Gong et al. 2005), mutant lines (Robinson 2002) or hybridity (Cassani and Caton 1986; Zajicek et al. 2011). Genetic engineering can include transgenic (recombination across species barriers), cisgenic (across closely related species) or intragenic approaches (engineering of host-only sequences) such as daughterless carp (Thresher 2007; Thresher and Kuris 2004). In some jurisdictions, there are distinctions of legal importance among these approaches (see below and Nielsen 2003 for further discussion of conceptual scheme).eering in general. The International Symposium on Genetic Biocontrol of Invasive Fish held in Minneapolis, Minnesota in June 2010 was an important ﬁrst step towards informing the key regulatory agencies about the need for genetic biocontrol, the status of the science, and the environmental risks. The next step is for researchers and agency personnel to build on this foundational knowledge to develop decision-making frameworks within the existing regulatory regime that ensure fair and accurate assessment of genetic bio- control technology and its associated environmental risks.

## Food Security Extensions

### Chinese Industry Decline Inevitable-Extensions

**Chinese industry will inevitably decline-The U.S. must be able to fill in for demand**

Chris **Andrikos, 2013**, “CHINA: The Seafood Empire, *Fishery News*, May 1st, <http://usfishlaw.com/like-in-many-other-industries-china-leads-the-way-in-aquaculture-producing-70-of-all-the-worlds-farmed-fish/>, [accessed May 6th, 2014]

The Chinese population is predicted to rise from 1.5 to 1.7 billion by 2026 according to the FAO. While technology and culture principles keep production steady, the per capita share of land resources for food production are decreasing with a rising population; hence, the need for domestic markets. China today feeds 22% of the world’s population, by producing 70% of aquaculture products from only 30% of fresh and marine waters useable. The point being, while production and population increase, the height of the demand will plateau with direct influence from the amount of tangible resources. In order to remain completely sustainable, land, feed, and water resources will ultimately limit production. This together with the timely rise in transportation costs will eventually lead to decreases in exports from Chinese mainland and the following rise in domestic production. Domestic transitions have not happened yet because there are more Americans making money in import/export business of seafood than the direct production of the same species.¶ According to the World Fish Center “China is a country with limited freshwater, much like any other nation. Environmentally sustainable production systems are urgently needed, namely water-saving, land-saving, feed-saving, and low-waste culture systems.” Since before this statement was made, culture authorities and major industry leaders have known that water and land is not an infinite resource. The estimated annual rate of increase in aquaculture products is about 6%. The goal of most farmers in the well-adaptive nation is to utilize water area for culture to gradually improve the output per unit area, in itself the most sustainable means of production.¶ However, Americans must be aware that Chinese production will plateau at some point in history, when this happens the domestic gap must be filled; the safest way to accomplish this is through domestic farm propagation.

## Solvency Extensions

### FWS=Key/A2 Agent CP

FWS is key and no agent CP solves

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

This paper provides an overview of the U.S. regulatory framework governing genetic biocontrol efforts for invasive ﬁsh. Genetic biocontrol refers to the intentional release of genetically modiﬁed organisms (GMOs) into the environment to control a target population of a non-native species. The terms ‘‘genetically modiﬁed’’ and ‘‘genetically engineered’’ are often used interchangeably, despite the scientiﬁc distinctions. A GMO is an organism that has had its genetic material altered or modiﬁed by humans through any method, including conventional breeding. Genetic engineering, as deﬁned by the Food and Drug Administration (FDA), is the use of recombinant DNA techniques to introduce new characteristics or traits into an organism. GE organisms are therefore a subset of GMOs. As this paper will discuss, existing laws focus on GE organisms raising signiﬁcant questions as to whether organisms modiﬁed without utilizing rDNA techniques fall within the jurisdiction of any federal agency. Under the 1986 Coordinated Frame- work for Regulation of Biotechnology, three federal agencies have primary responsibility over biotechnology—the Environmental Protection Agency (EPA), the U.S. Department of Agriculture, and the FDA. Because the EPA has exempted biological control agents from regulation as pesticides and no ﬁsh species are currently considered plant pests, the FDA is the agency responsible for approving the use of genetically engineered ﬁsh for biocontrol. FDA regulates genetically engineered animals through its New Animal Drug Application (NADA) process. The NADA process presents several challenges to effective and transparent regulation of genetic biocontrol, including the FDA’s focus on drug safety, secrecy provisions potentially limiting disclosure of the results of environmental reviews, and the secondary role of the Fish and Wildlife Service, the federal agency with the most experience with invasive species management. In addition, relying on the NADA process creates a signiﬁcant regulatory gap as NADA approval is only required for GE organisms. The regulatory framework for GMOs created for genetic biocontrol without rDNA technology is unclear and primary responsibility may fall to the states. Given its extensive experience with hatcheries, invasive ﬁsh species control, and environmental reviews, the Fish and Wildlife Service (FWS) is the more appropriate agency to review applications for genetic biocontrol. Efforts should be undertaken now, while genetic biocontrol is still in the theoretical stages, to increase the role of the FWS in the permitting process either through formal regulations or more informal mechanisms such as memorandum of understanding.

### Regulatory Framework=Key

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Although rDNA techniques have yet to leave the laboratory, researchers are exploring whether a trans- genic ﬁsh could be developed that when released would bear a deleterious genetic construct designed to disrupt a speciﬁc aspect of the organism’s life cycle or biology. (Kapuscinski and Patronski 2005). Australian scientists, for example, have investigated whether the common carp could be genetically engineered to produce only male offspring. (Thresher and Bax 2003). In theory, such ‘‘daughterless’’ genes, when introduced into the target invasive species population, would ultimately drive the species to extinction. Although there are established regulatory frame- works in the US for classical biological control, biological control efforts utilizing genetically modiﬁed organisms as the biological control agent will be subject to a complex, still evolving approval process. Further- more, the federal agencies with primary authority over GMO approvals have little to no experience with invasive species management. In addition, the following analysis of the range of biological control options for invasive ﬁsh reveals overlaps and gaps in the federal regulatory framework that open the door for additional regulation by affected states. Without a rigorous and comprehensive review process, there is increased risk that emerging technologies such as genetic biocontrol will be implemented beforethe potential environmental consequences are fully vetted and understood.

### A2 EPA Jurisdiction

The aff is not subject to EPA regulation-It’s ceded authority

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Environmental Protection Agency The EPA regulates the sale and distribution of pesticides in the U.S. pursuant to the Federal Insec- ticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. § 136 et seq). A pesticide is any substance intended for a pesticidal purpose, including prevent- ing, destroying, repelling, or mitigating a pest. Because the release of GE ﬁsh would be for the purpose of controlling an invasive species (a pest), the statutory language suggests that GE ﬁsh could be classiﬁed as a pesticide and subject to EPA regulation. The EPA, however, has exempted all biological control agents, except microorganisms and plant- incorporated pesticides, from the requirements of FIFRA. (40 C.F.R. § 152.20). EPA has, by regulation, deﬁned biological control agents as any living organ- ism applied to or introduced into the environment that is intended to function as a pesticide against another organism declared to be a pest. This exemption was based on the EPA’s determination that such agents are adequately regulated by other federal agencies, i.e., USDA and the FDA.

### FDA Fails

#### **FDA fails at jurisdiction over GE animals-Causes environmental impact statements to not happen**

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Although the FDA has asserted authority over GE animals, the agency has taken the somewhat contro- versial position that it does not always need to exercise that authority. For instance, if the GE animal is a non- food species regulated by other agencies (i.e., GE insects developed for plant pest control subject to APHIS oversight) or raised and used in controlled conditions, such as laboratories, it is the FDA’s policy to exercise ‘‘enforcement discretion,’’ i.e., not enforce the NADA requirements. (FDA 2009). The FDA may also choose to exercise enforcement discretion, based on an evaluation of risk factors, for additional kinds or uses of non-food species of GE animals. In making its determination, the FDA will consider such factors as: • Whether there is anything about the article itself that poses a human, animal, or environmental risk; • Whether, in the event of an environmental release, the GE animal poses any more of any environ- mental risk than its non-GE counterpart; • Whether there are concerns over the disposition of GE animals that could pose human, animal, or environmental risks; and • Whether there are any other safety questions that have not been adequately addressed by the sponsor. (FDA 2009). these genetically engineered zebra danio ﬁsh pose any more threat to the environment than their unmodiﬁed counterparts which have long been widely sold in the US. In the absence of a clear risk to the public health, the FDA ﬁnds no reason to regulate these particular ﬁsh.’’ (FDA 2003). This decision was controversial within the envi- ronmental community. By focusing on the intended use of the GloFish as a domestic pet, as opposed to livestock or food, the FDA appeared to disregard the fact that aquarium ﬁsh are often released into the environment. Although the risk to the environment might be low, as it is unlikely that single releases of GloFish into waterbodies would result in breeding populations or food chain impacts, the potential for harm does exist as aquarium releases have been linked to signiﬁcant invasions in Florida (lionﬁsh) and California (Caulerpa taxifolia). The FDA’s exercise of enforcement discretion, however, avoided the need to conduct environmental reviews pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.). The Food and Drug Administration has exercised enforcement discretion with respect to GE animals. In 2003, the FDA declined to regulate the GloFish,a transgenic ﬂuorescent zebraﬁsh. The Gloﬁsh’s ﬂuo- rescent color is achieved through the addition of a ﬂuorescent protein gene naturally occurring in other marine organisms, such as sea anemones. On Decem- ber 9, 2003, FDA announced that: ‘‘Because tropical aquarium ﬁshare notusedforfoodpurposes,theypose no threat to the food supply. There is no evidence that these genetically engineered zebra danio ﬁsh pose any more threat to the environment than their unmodiﬁed counterparts which have long been widely sold in the US. In the absence of a clear risk to the public health, the FDA ﬁnds no reason to regulate these particular ﬁsh.’’ (FDA 2003). This decision was controversial within the envi- ronmental community. By focusing on the intended use of the GloFish as a domestic pet, as opposed to livestock or food, the FDA appeared to disregard the fact that aquarium ﬁsh are often released into the environment. Although the risk to the environment might be low, as it is unlikely that single releases of GloFish into waterbodies would result in breeding populations or food chain impacts, the potential for harm does exist as aquarium releases have been linked to signiﬁcant invasions in Florida (lionﬁsh) and California (Caulerpa taxifolia). The FDA’s exercise of enforcement discretion, however, avoided the need to conduct environmental reviews pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.).

### FDA CP = No EIS

The FDA fails-Doesn’t mandate EIS for GMO fish

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

The National Environmental Policy Act requires federal agencies to prepare environmental impact statements for all major federal actions signiﬁcantly affecting the quality of the human environment. When the FDA exercises enforcement discretion, however, courts have ruled that is a decision not to take action. There is no federal action, therefore, to trigger environmental reviews. Although the FDA does consider environmental risks when deciding whether to exercise enforcement discretion, as noted above, those four questions do not necessarily examine the entire range of environmental impacts that would be addressed in a full environmental impact statement. Following the FDA’s GloFish announcement, the International Center for Technology Assessment challenged the FDA’s failure to prepare an environ- mental impact statement in federal court. In 2006, the U.S. District Court for the District of Columbia, in International Center for Tech. Assess. v. Thompson, 421 F. Supp.2d 1 (D.D.C. 2006), upheld the FDA’s decision ﬁnding that the decision of whether to regulate the GloFish was committed to the agency’s discretion and furthermore that there was no ‘‘major federal action’’ which triggered NEPA. According to the court, ‘‘The FDA’s decision not to regulate GloFish is not an agency action, but rather, an agency inaction.’’

#### FDA won’t properly exercise authority

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

National Environmental Policy Act Although the FDA could exercise enforcement discretion over a GE ﬁsh developed for biological control, it is unlikely they would do so. Such GE ﬁsh would be intentionally released into the environment in order to spread their engineered genes to invasive ﬁsh in the target ecosystem, a situation that raises very different environmental concerns than those associ- ated with the GloFish. In addition, once released into the environment, the GE ﬁsh have the potential, depending on the species, to enter the human food chain. Food and Drug Administration regulations require that the NADA include an environmental assessment (EA) prepared by the sponsor. An EA is the ﬁrst step in the environmental review process. The purpose of the EA is to determine whether the proposed activity will have a signiﬁcant impact on the environment. In the EA, the sponsor must consider all relevant environmental issues relating to the use and disposal of the regulated article, here the GE ﬁsh. If signiﬁcant environmental impacts are anticipated, the agency must prepare a full environmental impact statement (EIS). If it will not have a signiﬁcant impact, no additional environmental reviews need to be undertaken. The National Environmental Policy Act authorizes federal agencies to exempt certain activities from the environmental review requirements. These exemp- tions are known as categorical exclusions. FDA has issued a categorical exclusion for drugs intended for use in non-food animals. (21 C.F.R. § 25.33(d)(1)). NADA applications for drugs intended for use in non- food animals, therefore, do not ordinarily require the preparation of an EA or EIS. As many ﬁsh under consideration for genetic biocontrol are not food species, the existence of this categorical exclusion raises some concern as a GE ﬁsh could theoretically be approved with no environmental review. Fortunately, the White House Council on Environmental Quality (CEQ), the federal agency overseeing NEPA imple- mentation, requires agencies prepare at least an EA for actions that normally would be excluded if extraordinary circumstances indicate the action may signiﬁcantly affect the environment. (40 C.F.R. § 1508.4).

### Solvency Extension-FDA Fails/FWS Good

Showalter-Otts, 14 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Discussion

Because regulation of biotechnology in the U.S.focuses on the use of biotechnology products, as opposed to the technology used to create the product, the challenge for proponents of genetic biocontrol will be determining where this use ﬁts into the existing regulatory frame- work. Although the USDA has the most experience with classical biological control,GE ﬁsh are unlikely to be classiﬁed as plant pests and therefore currently fall outside the agency’s regulatory reach.EPA has likewise limited its authority by regulation to plant-incorporated pesticides and microorganisms. The primary responsibility for approving the use of GE ﬁsh for biocontrol, therefore, falls to the FDA. This is an awkward ﬁt. The FDA is not an environmental agency. Its primary responsibility is ensuring the safety of the U.S. food and drug supply. The primary responsibility of the FWS, on the other hand,istoconserve,protect,andenhance ﬁsh,wildlife, plants, and their habitats. In addition, assessing ecological risks and beneﬁts of genetic biocontrol is very challenging and the FDA, unlike the FWS, lacks the serious depth and breadth of ﬁsheries scientists, aquatic community ecologists, ﬁsh conservation biol- ogists, and statisticians needed to adequately review EAs and conduct EIS for genetic biocontrol. Finally, the FDA’s environmental decision-making processes are less transparent than other agencies as a result of mandates in the Trade Secrets Act. The Food and Drug Administration’s experience with AquaBounty’s NADA for AquAdvantage Atlan- tic salmon has highlighted the problems with the existing regulatory framework. As mentioned above,

AquaBounty submitted anNADA for the GE salmon in the late 1990s. Over the years, there was a lot of speculation regarding the application, but little infor- mation available due to FDA’s secrecy. Recognizing the need to increase the transparency of the process, the FDA publically released a brieﬁng packet summarizing the FDA’s process for determining the safety and effectiveness of the AquAdvantage salmon and pro- vidingsomeofthe dataandinformation that the agency evaluated as part of the NADA process on September 10, 2010. The brieﬁng packet, which included an environmental assessment prepared by Aqua Bounty, was released in advance of a meeting of the Veterinary Medicine Advisory Committee (VMAC). The VMAC reviews and evaluates available data concerning the safetyandeffectivenessofnewanimaldrugsandmakes recommendations to the FDA regarding scientiﬁc issues and regulatory policy. (FDA 2010b). Although the FDA should be commended for publically releasing this information prior to making a ﬁnal decision, the brieﬁng packet raises concerns for some organizations about the FDA’s decision-making process and environmental risk assessment. In the brieﬁng packet the FDA stated, ‘‘There is substantial, reliable information available in the environmental assessment document to conclude that GE Atlantic salmon…are notexpected to have a signiﬁcant impact on the qualityof thehumanenvironment’’ and,as such, ‘‘there appears to be adequate justiﬁcation at this time for preparation of a ﬁnding of no signiﬁcant impact,’’ signalingthatFDAispoisedtoapprovethisapplication based on the company’s EA and without preparing an EIS (FDA 2010a). The FDA reached this conclusion becauseofthespeciﬁcconditionsofproductionanduse proposed by Aqua Bounty—land-based culture at one hatchery and one small commercial growout farm with multiple and redundant containment mechanisms. Although these conditions do signiﬁcantly reduce the likelihood of escape, given the controversy surround- ing genetically engineered foods and the debate with respect to their potential environmental impact, it is a bit astonishing to learn that the FDA might attempt to proceed through the approval process without prepar- ing a full environmental impact statement. Strong criticism of the FDA’s approval process and its environmental risk analysis swiftly followed the release of the brieﬁng packet. In written comments submitted to the FDA, the Conservation Genetics Community of Practice within the U.S. Fish and Wildlife Service stated that AquaBounty’s environ- mentalassessmentwas‘‘overlysimplisticand[did]not adequately capture the actual risk of environmental damages to wild Atlantic salmon or the ecosystem.’’ (Conservation Genetics COP 2010). Economists have criticized the FDA for neglecting to consider the potential impacts of market expansion of AquAdvan- tage salmon on the global commons and wild stocks of salmon. (Smith et al. 2010). Congress has also been strongly critical of FDA’s decision-making process. Following the VMAC hear- ings, Congressional leaders in the House and Senate sent letters to theFDA urging theagencytosuspend its approval process for AquAdvantage salmon calling the environmental review ‘‘ﬂawed’’ and ‘‘wholly inadequate.’’ On September 29, 2010, Senator Young of Alaska went a step further, introducing a bill (H.R. 6265) that, if passed, would prevent FDA from approving any genetically engineered ﬁsh under the Federal Food, Drug, and Cosmetic Act. Overall, there appears to be a signiﬁcant lack of trust and conﬁdence in the FDA’s environmental review process with respect to GE animals intended for food. To build conﬁdence and public trust in its decision- making process, FDA must ensure that the potential environmental impacts are adequately analyzed with respect to all new animal drug applications. The most obvious way to do so would be to undertake a rigorous environmental risk assessment resulting in the produc- tion of a full EIS. If the FDA does approve AquAd- vantagesalmonwithoutpreparingafullEIS,litigation will almost certainly follow alleging violations of NEPAandotherfederallaws.Suchlitigationcoulddrag onforyears andpotentiallymakeitmuchmoredifﬁcult to gain approval for genetic biocontrol projects. One ﬁnal concern is the FDA’s deﬁnition of genetically engineered. The FDA’s focus on animals modiﬁed by rDNA techniques exposes a regulatory gap in federal oversight of genetic biocontrol efforts. Theoretical modeling suggests that the release of sex-reversed ﬁsh containing two Y chromosomes may be a more effective control technique than sterile male release (Gutierrez and Teem 2006; Teem et al. in review). The ‘‘Trojan Y’’ chromosome ﬁsh are produ- ced by exposing male ﬁsh or eggs to estrogen. This hormone exposure results in a female ﬁsh capable of mating and laying eggs but carrying XY chromosomes instead of the normal XX. When the XY female is mated with a XY male, one-quarter of her offspring will be males with two Y chromosomes. Exposing these ‘‘supermales’’ as young fry to high dosages of estrogen, results in a female with two Y chromosomes. The mating of a YY female with a normal XY will result in all male offspring. Theoretically, the intro- duction of Trojan Y ﬁsh into an invasive population would over time shift the sex ratio of the population until only males remain thus triggering a population crash. Although the Trojan Y ﬁsh would be created through genetic manipulations, they would not be considered ‘‘genetically engineered’’ because rDNA methods are not used. It is unclear whether any federal agency would have oversight over the use of such technology. However, as the responsibility would likely fall to a state natural resource agency to permit under state laws, the FWS might be able to gain oversight by offering testing and certiﬁcation services to the states as the agency has done with triploid grass carp. As genetic biocontrol research progresses, addi- tional regulatory gaps are likely to emerge given the range of technology available. Although the FDA’s NADA decision-making process can be improved, its legal authority can be stretched only so far. If GE ﬁsh are being developed for use as food (i.e., AquAdvan- tage Salmon), FDA approval is appropriate and well within the agency’s statutory authority under the FFDCA. However, if GE ﬁsh are being developed for use in biocontrol programs, requiring approval from the FDA makes less sense. The FWS or NOAA Fisheries might be the more appropriate agency. The Coordinated Framework is a statement of policy issued by Executive Ofﬁce of the President, not a law enacted by Congress. As such, it could be updated and/or revised by the President at anytime. Given the controversial nature of genetic engineering in the US, revising the Coordinated Framework to delineate the authority of another agency would not be an easy process. However, it may be easier to close regulatory gaps through revisions to the Coordinated Framework than to secure passage of new legislation. Conclusion Researchers hoping to move genetic biocontrol out of the lab and into the ﬁeld have a long journey ahead. Although the journey is not impossible, it will be challenging and regulatory hurdles will be high due to the controversy that surrounds genetic enginInvasive and unwanted species are increasingly recognized as serious problems of social, economic and biological concern. At the same time, our ability to understand and manipulate organisms at a genetic level is rapidly expanding. Applications to the control of invasive fish are emerging as an important area of innovation in this regard, as reflected in this special edition, although applications in other areas, especially insects, are also advancing rapidly. Aside from the technical challenges involved, genetic approaches to invasive species control are creating new challenges for regulation and oversight. Developments in one taxon in one jurisdiction likely will have implications for work on other taxa elsewhere. To analyze this challenge and its implications for work on invasive fish, we define a new category of biotechnological endeavor that applies to all taxa, genetic biocontrol (GBC), and use it to explore the wide array of legal and policy instruments applicable to its oversight.

### A2 Unsafe

#### GM Fish Safe-FDA says so

Baily ’13- Conner, ¶ Professor of Rural Sociology¶ Department of Agricultural Economics & Rural Sociology College of Agriculture¶ Auburn University¶ 2013 Remaking Fish for Aquaculture in the United States From Selective Breeding to Genetic Engineering http://www.sifo.no/files/file79294\_professional\_report\_4-2013\_web.pdf

Food safety concerns associated with GE fish include unintended uptake and retention of toxins, increased likelihood of allergic reactions, or exposure to hormone residues. Exposure to toxins is regarded as unlikely and hormones are rendered harmless when seafood is cooked, though raw fish consumed as sushi could retain biologically active hormone residues (Pew Initiative on Food and Biotechnology 2002). Allergic responses can be caused by exposure to proteins, and our knowledge of proteins and parts of proteins that may be found in transgenic fish but not in the original species is incomplete (Pew Initiative on Food and Biotechnology 2002).¶ The FDA began its food safety review of ABT salmon following guidelines it established in 2009 (FDA 2009) whereby GE animals are regulated under animal drug provisions of the Federal Food Drug and Cosmetic Act (FFDCA, 21 USC 321 et seq.). The FFDCA defines drugs as “articles (other than food) intended to affect the structure or any function of the body of man or other animals” (Section 201(g)). The FDA considers that the recombinant DNA construct involving genes from Chinook salmon and ocean pout meet the definition of a drug for purposes of the FFDCA. This classification is im- portant because the FFDCA imposes strict confidentiality requirements on the FDA.¶ The decision to consider genes from different species to be drugs places ABT’s AquAdvantage® salmon under the jurisdiction of the FDA’s Center for Veterinary Medicine. In 2010, this Center reported that there were no sig- nificant food safety issues (FDA 2010a; Kane 2012). Specifically, the FDA determined that the flesh of AquAdvantage® salmon was indistinguishable from that of other salmon (FDA 2010a), a finding later confirmed in the FDA’s draft Environmental Assessment (FDA 2012b). “With respect to food safety, FDA has concluded that food from AquAdvantage® salmon is as safe as food from conventional Atlantic salmon, and that there is a reasonable cer- tainty of no harm from consumption of food from triploid AquAdvantage® salmon ” (FDA 2012b:2).

#### GMO salmon safe-measures prevent problems

Salzberg ’11-Stevel Salzberg is a professor of Medicine and Biostatistics in the Institute of Genetic Medicine at Johns Hopkins School of Medicine, where he is also Director of the Center for Computational Biology. “They Engineered A Better Salmon, So Why Is Congress Blocking It?” http://www.forbes.com/sites/stevensalzberg/2011/07/04/they-engineered-a-better-salmon-so-why-is-congress-blocking-it/

These new salmon are nothing to be afraid of, but anti-GMO activists have labelled them “Frankenfish” as a transparent scare tactic. I’m neither a fan nor an opponent GMO foods, but knee-jerk opposition to all GMOs doesn’t make any sense. Modifying crops to make them more resistant to pesticides, as Big Agriculture firms (Monsanto in particular) have done, strikes me as a terrible use of the technology. “Roundup Ready” corn and soy allow Monsanto to sell more of their herbicide, and make farmers dependent on it. If anti-GMO forces want to boycott this type of genetically modified organism, I’m on their side.¶ But not with salmon. AquaBounty salmon doesn’t promote the use of pesticides or other industrial chemicals. It just makes salmon farming more efficient. The genes added to the salmon are naturally-occurring ones from other fish, so they are still 100% fish. (In contrast, GM crops have genes injected into them from bacteria and other foreign species.) Furthermore, the farming operations by AquaBounty are all inland farms, so there’s almost zero chance of the fish escaping into the wild. (I went to one of the FDA hearings last fall and heard a detailed description of the farms.) And even if they did escape, it wouldn’t matter because the AquAdvantage salmon are sterile, and couldn’t breed with wild fish.¶ Despite these facts, environmental organizations such as Food and Water Watch are waging a campaign to “Stop Frankenfish,”, and spreading misinformation about the science. I was particularly disappointed by the comments from the Union of Concerned Scientists at last September’s FDA hearing. Jane Rissler from the UCS compared GM salmon to the massive BP oil spill in the Gulf of Mexico, a ridiculous bit of overstatement. I thought the UCS were the good guys! I agree with their stances on many issues, but they do not speak for me on this one.

### FWS Can Have Jurisdiction

FWS can have jurisdiction

Showalter-Otts, 14 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Some of the factors federal agencies are required to consider when determining whether an EA isnecessary for an excluded activity are the degree to which the effects are likely to be highly controversial, the degree to which possible effects are highly uncertain or involve unique or unknown risks, and the degree to which the decision might set a precedent. (CEQ 2010). As an application to release a GE ﬁsh into the environmental for biocontrol purposes is likely to be highly controversial, involve highly uncertain and unique risks, and have high precedential value, an EA would almost certainly need to be prepared due to extraordinary circumstances. In addition, courts have consistently held that federal agencies must prepare an EIS in compliance with NEPA when their approvals will result in the delib- erate release of GE organisms into the environment. The US Supreme Court conﬁrmed this legal requirement most recently in Monsanto Co. v. Geertson Seed Farms, 130 S. Ct. 2743 (2010). Continued existence of a species listed as endangered or threatened or adversely modify such species’ habitat. As part of the decision-making process, federal agencies are required to consult with the FWS to determine how the proposed action would affect threatened and endangered species. Many endangered and threatened species gained that unfortunate status, in part, because non-native species invaded their habitat. (Pimentel et al. 2005). As a result, it is likely that the FDA would have to consult with the FWS during the NADA process to ensure that the approval of a GE ﬁsh for biocontrol would not jeopardize a listed species. Following consultation, FWS would provide the FDA with a written statement, known as a Biological Opinion, that details how the action may affect listed species. If the FWS would determine that jeopardy or adverse modiﬁcation is likely, the FWS must suggest reasonable and prudent alternatives the FDA could adopt to avoid those negative impacts. In addition, a provision of the Lacey Act (18 U.S.C. § 42) provides the FWS with the authority to prohibit the import and transportation of species ‘‘injurious to human beings, to the interests of agriculture, horticul- ture, forestry, or to wildlife or the wildlife resources of the US.’’ For example, silver and black carp are listed as injurious and therefore may not be imported into the US or transported within the country. If a GE ﬁsh was found to be injurious, the FWS could potentially restrict its use through a Lacey Act listing.

### FDA Fails-Extension

#### research on gm fish is not enough

mcevilly, 2013—Michael p., Duke University School of Law, J.D./M.A. (Philosophy) candidate, 2013; Washington University in St. Louis, B.A. in Philosophy and B.A. in Religious Studies, 2009., LACK OF TRANSPARENCY IN THE PREMARKET APPROVAL PROCESS FOR AQUADVANTAGE SALMON, Duke Law & Technology Review, apl

**The Committee agreed with the FDA that "there is no greater effect as a result of the incorporation of [the rDNA] construct than the****[\*424] normal selection process that takes place during domestication and improvement of domestic animals through selective breeding**." [n73](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true#n73) And the construct qua animal drug was unquestionably effective--the data was "straight up" that *AquAdvantage* Salmon grows faster than its conventional counterparts. [n74](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true#n74)

Despite these conclusions, **serious doubts were expressed** toward the end of the meeting with regard to the adequacy of the data used. [n75](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true#n75)Attendees raised concerns about the small sample sizes used in AquaBounty Technologies' research [n76](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n76) as well as the results of these studies. **[n77](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n77)Dr. Jodi Ann Lapidus of the Committee, characterizing the data as "fairly suggestive [and] preliminary,"****[n78](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n78) and the process as "a bit ad hoc,"****[n79](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n79)argued that a "more rigorous experimental design [and more] rigorous epidemiologic principles" were needed to answer some of the Committee's questions**. [n80](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n80)

#### extreme lack of transparency exists on gm fish

mcevilly, 2013—Michael p., Duke University School of Law, J.D./M.A. (Philosophy) candidate, 2013; Washington University in St. Louis, B.A. in Philosophy and B.A. in Religious Studies, 2009., LACK OF TRANSPARENCY IN THE PREMARKET APPROVAL PROCESS FOR AQUADVANTAGE SALMON, Duke Law & Technology Review, apl

Other complaints centered on the safety of the salmon and the environmental risks they posed. Generally, individuals were concerned with a few specific issues, including: disparities in the level of insulin-like growth factor 1 (IGF-1) between *AquAdvantage* Salmon and the control; [n81](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n81) disparities in the level of vitamin B6 between *AquAdvantage* Salmon and the control; [n82](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n82) the limited sample sizes in allergenicity tests; [n83](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n83) the lack of independent, peer-reviewed studies to support some data; [n84](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n84) general animal safety and health; [n85](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n85) and the  [\*425] limitations of the fertilization process and the risk of salmon escaping from the facility. [n86](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n86) More relevant to the issue at hand, **complaints were aimed broadly toward the lack of transparency and few opportunities for public input allowed by the approval process**. [n87](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n87)

The notice of the September 20th meeting was published in the Federal Register on August 26th, a mere three and a half weeks before the meeting date. [n88](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n88) **Darrell Rogers, of the Alliance for Natural Health in the United States, noted that scientific studies have either "not been released or have been released so late in the approval process that it is impossible for the public and experts to assess whether scientific burdens have been met.**" [n89](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n89) Jaydee Hanson, of the Center for Food Safety, added that the 180-page scientific assessment briefing packet was received by the public "only 10 days [before comments were due]." [n90](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n90) Ms. Hanson further stated that "the most striking thing was how little data the company had produced over the last 15 years. Or at least how little data was being provided to us. We have discovered today that there is data that is not in this dataset." [n91](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n91)

**Regulating****transgenic animals intended for human consumption under the FDCA ensures that the process takes place almost entirely behind closed doors. The Trade Secrets Act prohibits the FDA from sharing any information with the public before a decision is made on an application, in the interest of protecting the applicant's trade secrets**. [n92](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n92) The FDA does not even have the power to disclose whether an application exists until after publication of approval in the Federal Register. [n93](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n93) Sponsors may disclose the application, as AquaBounty Technologies has, but even then "no data or information contained in the  [\*426]  file is available for public disclosure before such approval is published[.]" [n94](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n94) The Commissioner may, however, "in his discretion, disclose a summary of selected portions of the safety and effectiveness data as are appropriate for public consideration of a specific pending issue, e.g., at an open session of a Food and Drug Administration advisory committee[.]" [n95](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n95) Regardless as to the oddity or inappropriateness of regulating rDNA constructs as animal drugs, this statutory policy is especially unsuitable for products designed for human consumption.

#### transparency of gm fish necessary—consumer trust and liaison between federal agencies

mcevilly, 2013—Michael p., Duke University School of Law, J.D./M.A. (Philosophy) candidate, 2013; Washington University in St. Louis, B.A. in Philosophy and B.A. in Religious Studies, 2009., LACK OF TRANSPARENCY IN THE PREMARKET APPROVAL PROCESS FOR AQUADVANTAGE SALMON, Duke Law & Technology Review, apl

***Create an Independent Body to Communicate with the Public about Food Safet****y*

On January 28th, 2002, the European Union adopted legislation authorizing the creation of a European Food Safety Authority (EFSA), an "independent source of scientific advice and communication on risks associated with the food chain." [n128](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n128) EFSA was created after a call for a new authority to "contribute to a high level of consumer health protection" and to "help restore and maintain consumer confidence." [n129](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n129) Premised on the belief that consumers "have the right to expect information on food quality and constituents that is helpful and clearly presented, so that informed choices can be made," one of EFSA's main goals was to directly communicate with the public in order to keep consumers informed of emerging food safety concerns and risks from certain foods. [n130](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n130)

**Even if risk assessment continues to be carried out by the FDA and its advisory committees like VMAC, the creation of an independent body to act as a liaison to the public and clearly communicate the goals****[\*432]  of the regulatory process, the status of disclosed NADAs, and potential risks and benefits of genetically engineered products intended for human consumption would help restore trust in the system.**

**The independent authority could also serve as a go-between for agencies who share regulatory authority over genetically engineered animals. For example, the Commissioner of the FDA is required to consult with the Assistant Administrator of the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) to produce "a report on any environmental risks associated with genetically engineered seafood products, including the impact on wild****fish stocks.**" [n131](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n131) **Leaked e-mails between senior scientists at the U.S.****Fish and Wildlife Services (FWS) and NOAA chronicle serious concerns about the FDA's treatment of genetically engineered salmon and the lack of consultation with other agencies**. [n132](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n132) One email from FWS staff to NOAA revealed that:

Shortly **after the Atlantic salmon was listed as endangered**, several of us from **USFWS and NMFS spent 2 days down in Maryland meeting with Aqua Bounty and FDA about development of genetically modified salmon** and discussion around the need for FDA to engage in Section 7 consultation with the Services. **We [the USFWS and NMFS] never heard a peep out of FDA or Aqua Bounty after that**. [n133](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n133)

Mr. Gregory Moyer, a regional geneticist from FWS, wrote a letter outlining criticisms and concerns regarding the VMAC briefing packet for*AquAdvantage* Salmon ten days after the public meetings. [n134](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n134) Members of the Conservation Genetics Community of Practice of FWS wrote a letter one week later arguing that the evidence provided in the briefing packet fell short of "providing an actual risk assessment of putative environmental damages in the event of escapement." [n135](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.960386.8221361708&target=results_DocumentContent&returnToKey=20_T20134622349&parent=docview&rand=1403739829962&reloadEntirePage=true" \l "n135) Because these letters were written two to three weeks after the public meeting and [\*433]  because no information has been publicly available since that time, there is no way to tell whether these criticisms were incorporated into the FDA's subsequent analysis of safety, or whether the FDA consulted with FWS, NMFS, or NOAA. An independent authority could help ensure that the FDA meets its statutory requirements of consulting with relevant agencies to assess the safety and efficacy of NADAs.

## Add-Ons

### Disease Add-On-Links

#### GM fish are used to study growth, food use, and disease resistance, including that of humans.

Muir '04 (William Muir, Professor of Animal Sciences at Purdue University, National Center for Biotechnology Information, "The Threats and Benefits of GM Fish," http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1299107/, ST)

In addition to commercial GM fish, transgenic fish are widely developed and used in many laboratories all over the world as models for understanding the mechanisms of growth and development, and disease resistance, or for studying human diseases. GloFish originally started its career at the National University of Singapore as a living indicator for environmental pollution. Proponents of GM fish point to the global problem of overfishing and depletion of fisheries when arguing for the use of any such GM fish in aquaculture. The Food and Agriculture Organization (FAO) of the United Nations estimates that worldwide demand for food fish will increase to 110 million tons in 2010 (FAO, 1999), mainly because of the growing populations in Asia, Africa and South America. Most of this fish will have to come from aquaculture. More intense aquaculture, however, can create environmental problems of its own, mainly through runoff wastes and population concentrations, which can be hotbeds for the development of viral diseases and parasites, such as sea lice, and may also threaten wild fish. To partially address problems of waste runoff, cold-extrusion floating feeds have been developed. These feeds neither break apart before they can be consumed, nor do they sink straight to the bottom. They now dominate the market, combined with computer-and-video-linked feeding systems to monitor feed intake in the water and shut off the feeding system when pellets begin to drop below the water level at which the fish are feeding. In addition, most jurisdictions require 1–2 dives a year, during which regulators monitor the benthos and, if sludge is building up, also require adaptive management. Similarly, antibiotic use has largely been replaced by vaccines; during the 1990s, antibiotic use in Norwegian aquaculture dropped by 98% (J. McGonigle, Aqua Bounty Technologies, Waltham, MA, USA, personal communication). But GM fish, proponents argue, could further ease some of these problems by providing better disease resistance, faster growth and improved food use. Clearly, some modifications aim mainly at increasing the economics of fish farms. Using faster growing fish allows facilities to produce more fish per year with less cost (Fig 1). Similarly, cold tolerance would allow farmers to expand aquaculture into colder and less populated areas, such as northern Canada or northern Norway, but would not necessarily improve the environmental impact of aquaculture. Other transgenes are more promising in that respect. Disease resistance would allow farmers to cut down further on antibiotics, insecticides or fungicides. Improved nutrient use would lower the impact of undigested food on the nearby environment. Furthermore, the aim of improving nutrient utilization is to use previously indigestible nutrients, such as phytic acid as a phosphorous source, to further reduce pollution while lowering costs for fish farmers. But no matter which transgene is used, the main benefit would still be to the native species—provided we can keep our farmed fish from escaping—as any improvements in aquaculture would take the pressure away from ocean fisheries. Opponents, even while acknowledging this argument, believe that GM fish nevertheless pose a serious threat to wildlife. If GM fish escaped from fish farms, they could further upset the oceans' delicate ecology, causing ecological disruption or species extinction. Transgenes that increase cold-, salt- or heat-tolerance could allow GM fish to expand into new territories. GM fish with higher disease resistance and better use of nutrients could outcompete wild relatives and change predator–prey relationships, and they could therefore occupy new ecological niches where wild species would usually not survive. Finally, by mating with wild fish, escaped GM fish could spread the transgene among the wild population, which could cause conflicting effects on mating success, viability in natural habitats and other fitness factors required for the species to survive. ...no matter which transgene is used, the main benefit would still be to the native species—provided we can keep our farmed fish from escaping—as any improvements in aquaculture would take the pressure away from ocean fisheries

#### GE fish more resistant to disease

Baily ’13- Conner, ¶ Professor of Rural Sociology¶ Department of Agricultural Economics & Rural Sociology College of Agriculture¶ Auburn University¶ 2013 Remaking Fish for Aquaculture in the United States From Selective Breeding to Genetic Engineering <http://www.sifo.no/files/file79294_professional_report_4-2013_web.pdf>

Genomic research is the study of the entire genetic makeup of a species and how genes interact with the whole organism. Major advances are being made in mapping the entire genome of several commercially important aquacultural species including salmon, catfish, cod, rainbow trout, tilapia, carp, striped bass, shrimp, oyster and scallop (Abernathy, Peatman and Liu 2010; Liu and Peatman 2010). Such mapping allows researchers to know where genes con- trolling desirable traits are located. Research on molecular genomics allows for determining if a species of fish possesses a certain desirable trait. When a trait of interest is identified a genetic marker can be identified. With this ge- netic marker, a DNA test can be done to determine whether a specific fish is well suited to be used in a breeding program. In short, genomic research pro- vides the tools for highly efficient and targeted selective breeding. Such ge- netic testing is the basis of advanced selective breeding programs in animal agriculture.

One promising area of genomic research is disease resistance. Working with the CxB hybrid at Auburn University, research is underway to identify genetic differences which allow the channel catfish to be more resistant to columnaris disease and to incorporate resistance to enteric septicemia found in the blue catfish. Genetic mapping also provides insights into growth rate, feed conversion efficiency, and processing yields (The Fish Molecular Genetics and Bio- technology Laboratory n.d.).

#### GM Fish Can Help Better Create Vaccines

**Muhhamet, et al, 12**- (Altunok,Peker Zerife, Serezli Ramazan, Tekinay Ahmet Adem, Kizak Volkan, Founders of Faculty of Fish, Operate on Izmir Katip Celebi University in İzmir, Turkey, Founders of Faculty of Fish, Operate on Izmir Katip Celebi University in İzmir, Turkey, Aquatic species health and vaccines, Biotechnology and Aquaculture in Sustainable Development, <http://eprints.ibu.edu.ba/1243/1/1.%20Biotechnology%20and%20Aquaculture%20in%20Sustainable%20Development.pdf>, DA)

Disease has become a primary constraint to sustainable aquaculture production and improvements in aquatic animal health are coming from modern biotechnology. Biotechnological tools such as gene probes and polymerase chain reaction (PCR) has showed great potential in this area. Genetically engineered (DNA) vaccines are also being developed to protect fish against pathogens and are expected to replace other methods of vaccine 188 production. In general, DNA vaccines contain only genes of the pathogen, which produce the antigen whereas conventional vaccines are made from live, weakened or killed pathogen. The cost of this technique is low compared to producing weakened live organisms and these vaccines more stable at normal temperatures. Previous studies showed that the non specific defense system can be stimulated using microbials such as lipopoliysacharides, peptidoglycans or glucans (Soltanian at al., 2009). This technology has been adopted for aquaculture to improve the health and well being of cultivated aquatic organisms. The development of new vaccines help the organisms recognize and fight diseases causing losses to millions of dollars annually throughout the world. It also prevents the using chemicals in aqauaculture, means preventing chemical pollution in environment and potential hazardaous effects to human health.

### Disease Add On-Impacts

**Mutated disease cause extinction**

**Discover 2000** (“Twenty Ways the World Could End” by Corey Powell in Discover Magazine, October 2000, http://discovermagazine.com/2000/oct/featworld)

If Earth doesn't do us in, our fellow organisms might be up to the task. Germs and people have always coexisted, but occasionally the balance gets out of whack. The Black Plague killed one European in four during the 14th century; influenza took at least 20 million lives between 1918 and 1919; the AIDS epidemic has produced a similar death toll and is still going strong. From 1980 to 1992, reports the Centers for Disease Control and Prevention, mortality from infectious disease in the United States rose 58 percent. Old diseases such as cholera and measles have developed new resistance to antibiotics. Intensive agriculture and land development is bringing humans closer to animal pathogens. International travel means diseases can spread faster than ever. Michael Osterholm, an infectious disease expert who recently left the Minnesota Department of Health, described the situation as "like trying to swim against the current of a raging river." The grimmest possibility would be the emergence of a strain that spreads so fast we are caught off guard or that resists all chemical means of control, perhaps as a result of our stirring of the ecological pot. About 12,000 years ago, a sudden wave of mammal extinctions swept through the Americas. Ross MacPhee of the American Museum of Natural History argues the culprit was extremely virulent disease, which humans helped transport as they migrated into the New World.

## CP Answers

### A2 Canada CP

#### GM fish outweigh benefits and there is lower confidence by the people in its success.

Schmidt '11 (Sarah Schmidt, writer for the Postmedia News, "Tolerance for Frankenfish is falling: survey; Fewer Canadians have faith in federal government's ability to safely regulate genetically modified foods," Postmedia News, Lexis, ST)

Support for genetically modified fish and animals is on the decline in Canada as more consumers grow skeptical of the federal government's ability to regulate these high-tech food options, a government-commissioned poll has found. Thirteen per cent of Canadians said they approve of GM fish as long as the usual level of government oversight and control is in place - an 11-point drop from five years ago. On the flip side, more Canadians this year do not approve of GM fish, except under very special circumstances - 37 per cent compared with 24 per cent in 2006. Meanwhile, only nine per cent approve of GM animals as long as the usual government oversight is in place, down from 14 per cent in 2006. Twenty-nine per cent do not approve of GM animals under any circumstance, a jump of eight points in five years. The survey, carried out in February and considered accurate to within 3.4 per cent, 19 times out of 20, cites "some erosion" in confidence in the government's safety and regulatory systems for biotechnology and a widening "regulatory gap" in dealing with new technologies for the growing skepticism. The results could prove a public relations challenge for the federal government, which is considering how to handle requests to commercialize genetically engineered fish and pigs. Agriculture Canada commissioned the Harris/Decima survey last fall after government officials hosted a series of meetings with AquaBounty Technologies Inc., part of pre-notification consultations with the company, which is looking to bring its genetically engineered salmon to dinner plates. The fish are engineered in Prince Edward Island, home to AquaBounty's research facilities, to grow to market size twice as fast as conventional salmon with a growth hormone gene from the Chinook and a genetic on-switch from the ocean pout. Health Canada is also reviewing a formal application from University of Guelph scientists to approve a genetically engineered pig for human consumption. Environment Canada has already signed off on the commercialization plan for the so-called "Enviropig," created in 1999 - the world's first transgenic animal designed to solve an environmental problem. The pigs, created with a snippet of mouse DNA introduced into their chromosomes, produce lowphosphorus feces. The survey results show that Canadians generally see the benefits outweighing the risks for bioproducts, but the "perceived risks clearly outweigh benefits" when the genetic modification of animals is considered. "New this year is the perception that the risks of GM fish outweigh their benefits as compared to a neutral score in 2006," the report notes. Close to one in four (23 per cent) say they are not at all confident in the government's ability to regulate GM fish - compared with 16 per cent in 2006. Meanwhile, the percentage of Canadians who are extremely or very confident in Ottawa's regulatory oversight stands at 14, down from 19 per cent. Confidence in Ottawa's ability to regulate GM animals is even lower. Twenty-seven per cent said they are not at all confident, a four-point increase from 2006. Eleven per cent said they are extremely or very confident in Ottawa's regulatory oversight of GM animals, a seven-point drop since 2006. Internal government records indicate some senior scientists from the Department of Fisheries and Oceans also have concerns, saying the government is "limited" and "may be constrained" by current regulations when considering an AquaBounty application to commercialize its research facility in P.E.I.

#### Huge backlash in Canada-No solvency

Doucette '13 (Keith Doucette, writer for The Canadian Press, "'Frankenfish' worries flare as modified salmon swims closer," The Canadian Press, Lexis, ST)

A U.S. company hoping to commercially produce genetically modified salmon eggs in Canada has cleared a major hurdle in its proposal to make the fish available for human consumption, a possibility that has critics worried about the prospect of "frankenfish" escaping and endangering wild Atlantic salmon around the world. Environment Canada's conclusion that the eggs are not harmful to the environment or human health when produced in contained facilities marks a significant step for Aquabounty Technologies, the company's CEO said Monday. But Ron Stotish said the hatchery in Souris, P.E.I., is still waiting for decisions from Health Canada and the U.S. Food and Drug Administration before the fish and eggs are available for sale. "We would be regulated as a novel food in Canada for actual consumption of the fish and that is a separate approval process," Stotish said. "At the moment, everything is still as it was. It's only the status of the facility moving from research and development to essentially a facility that could be used for commercial purposes." But Aquabounty's plans have drawn opposition from some state lawmakers in the U.S. including Alaska, and from environmental groups who fear that the genetically modified fish could escape their onshore farms and put wild populations at risk. In February, the public response was so strong that the U.S. Food and Drug Administration announced it was extending its comments period on its preliminary assessments of the fish, which found they posed no significant environmental impact. Lucy Sharratt of the Canadian Biotechnology Action Network said Environment Canada's decision is alarming because it was made without any public consultation and could help clear the way for the commercial sale of the world's first genetically modified food animal. "This is a concrete environmental risk now that's coming directly from Canada," Sharratt said. She said Ottawa's decision is a surprise since federal officials hadn't indicated publicly a review was underway. "Even after repeated requests [for information] we were never told that this decision was even being taken." Environment Canada said the decision was made by departmental scientists "based on a thorough scientific evaluation of the latest evidence and studies." The department also said that the federal government has effective regulations in place to protect the environment and human health from potentially adverse effects of genetically engineered organisms in Canada. Stotish said Aquabounty's proposal was subject to a risk assessment conducted by Fisheries and Oceans Canada involving a panel of independent experts in transgenics and fish containment technology. The sterile, all-female eggs were developed at Memorial University in Newfoundland and at the University of Toronto, and produced at the hatchery in P.E.I., while the fish are reared in Panama. The process sees the Atlantic salmon egg modified with genes from chinook salmon and an eel-like fish called the ocean pout. It makes the fish grow twice as fast as conventional fish.

### EIS = Normal Means

EIS is already required-The CP is not competitive

Showalter-Otts, 13 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

Some of the factors federal agencies are required to consider when determining whether an EA is necessary for an excluded activity are the degree to which the effects are likely to be highly controversial, the degree to which possible effects are highly uncertain or involve unique or unknown risks, and the degree to which the decision might set a precedent. (CEQ 2010). As an application to release a GE ﬁsh into the environmental for biocontrol purposes is likely to be highly controversial, involve highly uncertain and unique risks, and have high precedential value, an EA would almost certainly need to be prepared due to extraordinary circumstances. In addition, courts have consistently held that federal agencies must prepare an EIS in compliance with NEPA when their approvals will result in the delib- erate release of GE organisms into the environment. The US Supreme Court conﬁrmed this legal require- ment most recently in Monsanto Co. v. Geertson Seed Farms, 130 S. Ct. 2743 (2010).

### State Permutation

A federal-state partnership solves best

Showalter-Otts, 14 Stephanie, Director of National Sea Grant Law Center, The University of Mississippi Law School, “U.S. regulatory framework for genetic biocontrol of invasive ﬁsh,” Biological Invasions 16, pg. SpringerLink, ALB

State regulation of genetic engineered ﬁsh Although the federal government has primary responsibility with respect to biotechnology, state approval will also be required for the release of a GE ﬁsh into the wild. Several states prohibit the release of genetically engineered organisms without a permit or similar approval from a state natural resource agency. For example, in Michigan, a person may not introduce genetically engineered or nonnative ﬁsh unless the introduction has been authorized by the Department of Natural Resources. (Mich. Comp. L. § 324.41305). A genetically engineered organism in Michigan is ‘‘an organism whose genome, chromosomal or extrachro- mosomal, is modiﬁed permanently and heritably using recombinant nucleic acid techniques, or the progeny thereof.’’ (Mich. Comp. Laws § 286.872(m)). Cali- fornia prohibits the importation, transportation, or possession of transgenic aquatic animals except under a permit issued by the Department of Fish and Game. (Cal. Admin. Code tit. 14, § 671(c)(11)). Under California law, transgenic means ‘‘Genetically altered by introducing DNA (1) from another species or (2) through engineered endogenous constructs by means such as but not limited to recombinant DNA and RNA techniques to produce, gene addition, deletion, and doubling, or changing the position of the gene.’’ (Cal. Admin. Code tit. 14, § 1.92). In addition, states have primary responsibility for prevention, control, and management of biological invasions, including the use of biological control agents. For example, most states require a permit to release triploid grass carp, which are widely utilized for aquatic weed control, although a few states do exempt releases from permit requirements if the carp were bought from licensed dealers and stocked in private ponds and some states, such as Minnesota, ban importation of triploid and diploid grass carp. A few states also imposed permit conditions to minimize the environmental risk. To prevent escape from the target area, for instance, California and Nevada limit the release of grass carp to waters that are not connectedto other waters. California, Colorado, Connecticut, Flor- ida, Louisiana, New Jersey, and Utah require that barriers or screens be installed in the release area to prevent escape. California also prohibits releases within the 100-year ﬂoodplain. Although triploid grass carp are not regulated as GE animals because they are sterilized utilizing chromosomal manipulation, the regulatory approach is a potential model for GE biocontrol programs. To assist states with their aquatic weed management programs and provide assurances that shipments of grass carp do not contain diploid, and therefore fertile, grass carp, the FWS established a triploid grass carp inspection and certiﬁcation program. Almost all states permit only the sale and use of FWS-certiﬁed triploid grass carp. A similar federal-state partnership could facilitate the use of GE ﬁsh for biocontrol. Although state permits would still need to be obtained for the release, a certiﬁcation program could increase state agency conﬁdence in the product and streamline the approval process.

### A2 CBD/Cartagena Protocol on Biosafety CP

#### CBD/Cartagena Protocol doesn’t solve the aff

Gilna, Kusma, and Showalter Otts, 13 Ben, Fenner School of Environment and Society, Australian National University, GenOk, Jennifer, Humphrey School of Public Affairs, University of Minnesota, and Stephanie, National Sea Grant Law Center, University of Mississippi School of Law, “Governance of genetic biocontrol technologies for invasive fish,” *Biological Invasions*, Springer Science, ALB

Cartagena Protocol on biosafety The Cartagena Protocol on Biosafety to the CBD is the preeminent instrument for the regulation of the products of GM technology at the international level. Although a few nations prominent in GBC science are not party to the Protocol (e.g., the USA, Australia), 163 nations of the world have ratified this treaty as of mid-2012.6 Laws and regulations related to biosafety are compiled on the Biosafety Clearinghouse website.7 The Protocol aims to ensure the safe handling, transport and use of living modified organisms (LMOs) that “may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health”, with specific focus on transboundary movements. LMOs are any living organism that possesses a novel combination of genetic material obtained through the use of “modern biotechnology” (emphasis added), defined as: a. In vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or b. Fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection; The Protocol therefore applies unequivocally to transgenic, cisgenic and intragenic GBC agents, but not to agents produced by mutagenesis or artificial selection. The chemical and physical techniques used to manipulate chromosome number, as proposed for Trojan Y fish (Cotton and Wedekind 2007; Gutierrez and Teem 2006), likely would be excluded from its reference. The Cartagena Protocol’s particular definition of the products of biotechnology is considerably tighter than that provided in the Convention, but does not provide a mandate to oversee all forms of GBC agents. Parties are required to minimize risks of LMOs to biodiversity and human health and to prevent unintentional transboundary movements. Other than to mandate the provision of relevant information to an affected country, the Protocol does not specify appropriate responses were a dangerous LMO to cross into another nation. In terms of compliance, the Protocol is effectively toothless and mired in ongoing negotiations on the matter. The Cartagena Protocol is not therefore irrelevant to genetically modified fish for biocontrol, but limited to subset of applications (e.g. transgenic fish) and even then without much prescription. However, liability for damage incurred by LMOs (next section) may be more pertinent for situations where such modified fish might cross borders.

## A2 Ks

### Framework Card v. K

Public debate over the *policy details* of GBC fish are key-Our framework is most educational and critical to deliberative democracy

Gilna, Kusma, and Showalter Otts, 13 Ben, Fenner School of Environment and Society, Australian National University, GenOk, Jennifer, Humphrey School of Public Affairs, University of Minnesota, and Stephanie, National Sea Grant Law Center, University of Mississippi School of Law, “Governance of genetic biocontrol technologies for invasive fish,” *Biological Invasions*, Springer Science, ALB

Public engagement Many nations rely on “technological elites” in constructing technology policy, including risk policies. Industry developers, scientists, engineers and government regulators are called upon or given the opportunity to determine and execute the rules for decision making, a relatively small circle of people often from remarkably homogeneous backgrounds and understandings (Meghani and Kuzma 2010). Although there are benefits to this approach (e.g., technical competence), other voices may struggle to access narrow windows of opportunity for broader stakeholder and public input. In GBC, complex genetic mechanisms are typically conceived, investigated and debated in the relatively closed world of scientific journals or regulatory licensing, carrying with them a particular way of understanding both the problem to be solved and the solutions that may be viable. In at least a few instances, the inventors of particular GBC technologies have been closely involved in the establishment of policy and regulatory frameworks to govern their use (e.g., Beech et al. 2009; Mumford et al. 2009), and we are aware of undocumented examples of others. This could be a problem, partly because science and technology are socially constructed by the actors and networks involved (Bijker and Law 1994): a practical act of politics and a material component of policy. It follows then that public participation in policy and decision-making about science and technology are warranted in a democracy (e.g., Rip et al. 1995). The absence of that participation is thought to lie behind much of the global opposition to technology like genetic modification and the institutions that promote its use. New governance models suggest roles not only for the state and markets, but also for stakeholders and citizens in technology policy processes (Wilsdon and Willis 2004). Similarly, there is a substantial body of work that recognizes the importance of community engagement in environmental risk analysis and management for improving decision-making (e.g. National Research Council 1996; National Research Council 2008). Many governance regimes in environmental management and technology specifically mandate public consultation, engagement and debate in varying degrees, including some of the legislation presented above. In other cases, governance regimes are responsive to public input via overarching political processes, like lobbying and protest. Deficiencies remain, however. There are ongoing calls to develop and improve deliberative democratic approaches to technological decision-making (Bozeman and Sarewitz 2005; Jasanoff 2003; Kuzma and Meghani 2009). These include the governance regimes that apply to GBC (Kapuscinski and Patronski 2005).

#### And, our COMBINATION of public discussion and expert analysis is key

Aerni, 4 Philipp, PhD from the Institute of Agricultural Economics at ETH Zurich, Center for Comparative and International Studies, “Risk, regulation and innovation: The case of aquaculture and transgenic fish,” *Aquatic Sciences* 66 (2004) 327-341, ALB

Many of these questions cannot be answered by experts but need to be open for public discussion, although ex- perts can provide important information to guide public debates. Expert information will also be required to cre- ate an effective and robust regulatory framework that is strict enough to prevent abuse and well-known potential hazards, yet flexible enough to respond quickly to unanticipated new challenges. The crucial questions are how to address scientific uncertainty best in the regulation of transgenic fish, and to what extent the public accepts this uncertainty as the necessary price of technological development in aquaculture.

# Neg

## A2 Invasive Species Advantage

### Environment DA Links/Offense

#### \*\*\*Your choice as to whether to read this as a part of the environment DA or as a case turn-Regardless of your choice, you should pull stuff from the environment DA to answer this advantage as well

#### GM Salmon would destroy native species.

Gutierrez ’14-David, Journalist for the Epoch Times, GM Salmon Threaten Already-Declining Fish Populations, The Epoch Times, http://www.theepochtimes.com/n3/701308-gm-salmon-threaten-already-declining-fish-populations/

The commercialization of genetically modified (GM) salmon could push wild salmon species over the brink of extinction, warns marine ecologist Gerry Goeden in an article published on Independent Science News.¶ Goeden is a research fellow and advisor to the National University of Malaysia and marine consultant to the Andaman Resort, Langkawi.¶ The Genetic Danger of Farmed Fish¶ Although the FDA has not yet ruled on whether it will approve GM salmon for human consumption, U.S. company AquaBounty has already begun scaling up production of eggs for the GM fish in anticipation of a favorable ruling. If the GM salmon are commercialized, Goeden warns, they will only exacerbate the serious problems already caused by farmed fish to wild fisheries worldwide.¶ According to the Food and Agriculture Organization, 70 percent of the world’s wild fisheries have already failed or are in danger of failure due to overfishing and habitat destruction. This has led to an explosion in fish farming, such that 50 percent of the fish consumed globally is now produced from farms rather than caught at sea.¶ Salmon in particular have become so heavily farmed that farmed fish now drastically outnumber wild fish globally. These farmed salmon have been selectively bred over several generations (from combinations of different wild strains) to be faster growing and consume less food than wild fish.¶ “Around 95 percent of all salmon in existence are farmed,” said Matt Gage from the University of East Anglia, “and domestication has made them very different to wild populations.”¶ The only thing that enables this fast growth is the artificial conditions in which the fish are raised; if they had to live their entire lives in the wild, they would quickly be wiped out. In the short-term, however, farmed fish are able to outcompete wild fish by growing to sexual maturity faster and eating less food. And in spite of industry assurances, large numbers of farmed salmon have been proven to escape into the ocean each year, where they do indeed outcompete wild fish. A 2012 study into the fish stock collapse at the Sacramento River Chinook salmon fishery, published in PLOS One, found that wild fish had been overrun by hatchery fish to the extent that the wild population will probably never recover.¶ Another major threat to wild salmon is interbreeding with farmed fish, who spawn in the same rivers as their wild relatives. Genetic mixing dilutes the fitness of wild fish, making them less able to survive in a natural environment. A study published in PLoS Biology in 2008 found that when wild fish were exposed to hatchery-bred fish, their abundance fell by an astonishing 50 percent. A 2009 study in the journal Science found that crossbreeding with farmed fish had so genetically hampered wild steelhead trout (a close salmon relative) that they could no longer reproduce at the levels needed to maintain their numbers.¶ GM fish: Worse in Every Way¶ According to research conducted by Fredrik Sundstrom of the University of Gothenburg, Sweden, the GM salmon would have an even greater impact on wild fish than currently existing farmed fish already do.¶ “If transgenic fish become established in natural stocks they would be able to out-compete the natural breeds,” he said.¶ The GM fish are Atlantic salmon engineered with genes from eelpout and from Pacific Chinook salmon to enable them to overproduce growth hormones and grow two to six times faster during the winter.¶ “What we must keep in mind is that this animal has never existed before; it is new to the planet; we made it,” Goeden writes. “We really have no idea of what it will do when we lift it off the ‘operating table.’”

#### Turns Case-GE fish Could Become Invasive

Kimbrell ’14- CFS Senior Attorney George Kimbrell practices environmental and administrative law with a focus on the impacts of new and emerging technologies, “FDA and GE fish – the danger of rubber-stamp approval”, http://new.thehill.com/blogs/congress-blog/energy-environment/197007-fda-and-ge-fish-the-danger-of-rubber-stamp-approval

The possibility that a GE animal might become an invasive species and destroy the natural ecosystem is ignored by FDA. And if approved, the GE salmon will very likely have major effects on native salmon populations. These GE salmon are grown using genes from two other types of fish in order to speed its growth, and if escaped, could out-compete native species. One study found that if just sixty GE fish escape, it could result in the extinction of 60,000 native fish in less than forty fish generations.

#### Releasing GM Fish Would Terminate Its Targets and Cause Massive Atrocities

**Gilna et al, 11**- (Ben, Jennifer Kuzma, Stephanie Showalter Otts, Fenner School of Environment and Society, Australian National University, Canberra, Australi, Norwegian Center for Biosafety, Tromsø, Norway, Estacio ´n Biolo ´gica de Don ˜ana, CSIC, Seville, Spain, Humphrey School of Public Affairs, University of Minnesota, National Sea Grant Law Center, University of Mississippi School of Law, Kinard Hall, 26 November 2011, “Governance of genetic biocontrol technologies for invasive ﬁsh” Biol Invasions , Springer Link, DA)

GBC has a great potential for conﬂict between jurisdictions, with differences in national interest arising from clashes over the means and the objectives of GBC programs. To comply with the international biosafety regime, governments must perceive a net beneﬁt to the national interest, considering factors such as commercial incentive, protection, government reputation and legitimacy both within and between nations (Simmons 2010). These beneﬁts must be balanced against the potential costs of compliance, including times when the immediate interest of its citizens must be forgone for longer-term, overarching beneﬁts. We have already seen such difﬁcult calculations in GBC, even without the formal constraints of treaty obligations. New Zealand has and is pursuing ‘‘live’’ GBC agents against invasive possums that threaten industry and biodiversity (Cross et al. 2011), but such an agent would constitute serious risk to its nearby neighbor and trading partner, Australia—the origin of possums (Gilna et al. 2005). The European rabbit is threatened in its home range, but is often a serious pest in areas to which it has been introduced. GBC agents have been researched to address the ‘‘local’’ rabbit ‘‘problem’’ in both situations, but each program effectively created one more threatening process in the other territory (Angulo and Cooke 2002; Angulo and Gilna 2008b). National governments have sup- ported the work in each of these cases. The Cartagena Protocol seems to be principally constructed around a notion of a controlled ﬂow of material across national borders. ‘‘Unintentional’’ transboundary movements—as might be achieved by a GBC ﬁsh moving through waterways, ballast waters or even illegal introductions—are recognized as possible and risks are to be mitigated, but the assessment of such risk is fundamentally subjective, and its regulation is not prescriptive. The liability regime established by the Nagoya-Kuala Lumpur Supplementary Protocol seems particularly weak, watered down with exemptions and negotiable terms like ‘‘reasonable’’. Exactly what can be recognized as ‘‘damage’’ turns on contestable matters of valuation of biodiversity and any changes to it, likely to been seen in different lights from jurisdiction to jurisdiction. Similarly, the ‘‘reasonableness’’ of efforts to mitigate risk and correct damage is highly dependent on the value placed on the threatened object, and would likely be weighed against the expected beneﬁts of the ‘‘risky’’ activity. Were a target species to go extinct, for example, or an unwanted GBC agent establish itself in an unintended territory, it is difﬁcult to envisage adequate corrective measures being pursued, or even feasible. So far, in GBC programs for which a credible trans- border risk has been articulated, formal and informal arrangements (Henderson and Murphy 2007) have resulted either in risky GBC programs being discon- tinued, new research objectives formed or products not yet licensed (but see Angulo and Barcena 2007; Cross et al. 2011). There has not yet been a test case in invasive ﬁsh applications. However, it is not hard to imagine situations in which local, national interest is far stronger and more urgent than the interests of distant (and perhaps unfavored) societies on the other side of a border. Even if the nations concerned were party to the Cartagena Protocol (biosafety) and the Nagoya–Kuala Lumpur Supplementary Protocol (lia- bility and redress), the innovating nation could mount a justiﬁcation of its actions entirely consistent with the terms of these agreements. How could such a dispute be arbitrated and resolved? Mechanisms are as yet untested and perhaps poorly developed under this regime (Sagemueller 2005). If there were sufﬁcient negative effects on commercial interests from quarantine measures imposed as a result of the release of a GBC agent, the parties might seek arbitration in the WTO. This is not unlikely, in fact, because introduction of GBC agents via imported commodities is a plausible risk pathway (e.g. grain exports and an anti-fertility virus for mice; Williams 2007) and would rationally invoke quarantine restrictions that, in turn, could be chal- lenged by embargoed exporting nations (Angulo and Gilna 2008b). Whether environmental impacts would be adequately dealt with under the WTO regime remains an open question (Peel 2007). Even in cases where broad multinational consensus on the seriousness of the problem with the target species might be reached, the use of controversial technologies in GBC might be a point of conﬂict. Several mosquito GBC agents under development aim to tackle diseases that kill millions of people each year, sicken many millions more, and might indeed keep whole societies in an ongoing cycle of poverty and underdevelopment (Bonds et al. 2010). Few would argue with the seriousness of the problem, or the need to control vector insects. Many of these projects involve engineered ‘‘gene drive’’ systems, genetic elements that are designed to be invasive within the genome of the target species. Ostensibly, these transgenic elements would spread to all populations of the target mosquito species worldwide once released. Marshall (2010) observes that the Cartagena Protocol does not adequately cover the non-negligible risk of their escape from containment (in research or in transit), and that it imposes an implausible require- ment to win the consent of all nations across the globe that might eventually come to host such modiﬁed genotypes. Even an experimental release could become a global release of this form of GBC. A nation that suffers badly from diseases like malaria might quite reasonably decide that the risks of violating the obligations of a poorly applicable treaty are far outweighed by the need to act to protect its people from certain suffering. Other nations that may eventually host the GBC mosquito may take decidedly different views. This major issue seems likely to come to a head in the future, and its resolution will affect invasive forms of GBC in all taxa. The provisions of the current GBC oversight regime—particularly in compliance and arbitration—may not be up to the task of containing such a potentially ﬁerce debate without substantial change.

#### Nonnative fish tied to extinction of native species— escaping from facilities causes biological pollution

Johns 2013—Kristen L., Class of 2013, University of Southern California Gould School of Law; B.S. Environmental Systems: Ecology, Behavior and Evolution, University of California San Diego., FARM FISHING HOLES: GAPS IN FEDERAL REGULATION OF OFFSHORE AQUACULTURE, Southern California Law Review, apl

Biological pollution may be caused by the unintentional release of farmed **fish** into the ocean, which can harm native **fish** populations in a number of ways. Nonnative farmed **fish** can compete with native **fish** for food, habitat, or spawning grounds. In the Pacific Northwest, escaped **fish** from salmon farms have threatened or displaced native salmon populations for years, [n66](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n66) while many scientists believe nonnative escaped fish contributed to the extinction and endangerment of several native fish species, such as the bonytail and humpback chubs, the desert pupfish, the Gulf sturgeon, and the June and razorback suckers. [n67](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n67) Because farmed **fish** are either selectively bred or artificially engineered to mature faster and  [\*695]  grow larger, they can also alter the genetic makeup of wild populations by interbreeding, which can decrease that population's fitness. [n68](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n68) Scientists and policymakers alike are already calling for regulation of genetically modified or "transgenic" fish. [n69](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n69)Finally, **escaped fish can create biological pollution by introducing parasites and pathogens to native stock, the incidences of which are increased by aquaculture's practice of raising large densities of fish in small areas**. **One deadly pathogen, infectious salmon anemia ("ISA"), was first detected in the United States in Maine in 2001,**[**n70**](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n70)**and by 2011 had made its way to the West Coast.**[**n71**](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n71)**The virus, highly contagious, can kill up to 70 percent of fish on infected farms and could "devastate" Pacific salmon stocks if left unchecked.**[**n72**](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n72)**In fact, a 2007 outbreak of the virus was responsible for decimating the Chilean salmon aquaculture industry, reducing production by half and resulting in more than $ 2 billion in losses**. [n73](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n73)

Notably, **the risk of escaped fish may be higher in offshore aquaculture facilities since they are often more susceptible to damage by storms and are more likely to experience accidental releases of fish and their pathogens**. In fact, net pens - the kind currently used in most offshore [\*696]  facilities - are "extremely prone to **fish** escapes" because of their vulnerability to storm damage, accidents during transfers, and damage from boats or other marine life. [n74](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n74) Indeed**, nearly one hundred thousand Atlantic salmon escaped from net pens in Washington in 1996, with another three hundred thousand escaping from a single farm in 1997**. [n75](http://www.lexisnexis.com/lnacui2api/frame.do?tokenKey=rsh-20.808107.7399027827&target=results_DocumentContent&returnToKey=20_T20134598104&parent=docview&rand=1403739231431&reloadEntirePage=true#n75) Any potential offshore facility, therefore, must be regulated and managed to avoid this risk.

**While the application of overlapping jurisdictions to offshore aquaculture can lead to overregulation of certain environmental risks, it can also lead to underregulation of other risks. The impact of escaped nonnative and transgenic fish**on native species **is especially likely to avoid regulation.** Although the FDA has stated it intends to regulate the use of **transgenic fish** in aquaculture facilities, it has yet to promulgate any rules and has little expertise in dealing with impacts other than those on

#### GM fish pose a risk to environments in 5 years—no federal regulations exist yet

**Bisbee**, Dorothy W. "Preparing for a Blue Revolution." *Virginia Environmental Law Journal*. Virginia Environmental Law Journal, **n.d**. Web. 26 June 2014. <http://www.velj.org/preparing-for-a-blue-revolution.html>.

Early genetic engineering technology focused on microorganisms and plants. Among animals, most gene transfer work has been performed on mice for use as model systems for gene expression in vertebrates. **Only in the last decade have researchers learned to successfully integrate foreign genes into the chromosomes of fish, aimed at producing strains with traits such as increased cold tolerance and rapid growth rates. The technology is growing quickly**, and according to The New York Times, “ **strains of fish that grow bigger faster and are resistant to diseases could spark a ‘blue revolution’....” The process of fish gene transfers will probably be industrialized within five to fifteen years. At that time, significant numbers of genetically engineered, or transgenic, fish may enter natural waterways by escaping from fish farms or by intentional release into natural waters for sport fisheries, bioremediation or other purposes.**Numerous scientists have concluded that **genetic engineering is as safe as traditional techniques such as cross-breeding and fermentation**. Legitimate questions about the release of transgenic fish remain. **Past experience with exotics and hatchery-bred fish has indicated that the introduction of transgenics into natural waters could cause significant and irreversible harm to aquatic ecosystems, and to the economies which depend upon them**. **Ecological disasters have already occurred following introductions of non-engineered non-native fish**. Some scientists fear that engineered fish will cause even greater environmental upsets. And while the risks of catastrophic impact arising from individual introductions of transgenics are thought to be of low probability, the chances of ecosystem disruption will likely grow with the genetic engineering industry. Logically, the greater the variety and scale of releases, the greater the risk that one strain of genetically engineered fish will forever disrupt a broad range of natural aquatic ecosystems.  
**Transgenic fish pose concerns unique among genetically engineered organisms. Unlike plants or farm animals, fish escape easily, travel rapidly, and reproduce quickly**. Once genetically engineered fish have escaped or been introduced into natural waters, they may reproduce and transfer their novel traits to closely related wild species. Conversely, exotic fish generally cannot breed with native fish, and selectively bred fish can only have traits which already existed at some frequency in the species' gene pool. Transgenic fish may in the future express traits which allow them to outcompete other fish, to consume organisms humans consider to be undesirable, or to change their ranges or migration patterns**. Because novel traits may be chosen from a wide variety of sources and introduced quickly, transgenic fish may be more likely than selectively bred or exotic fish to cause these adverse effects, jeopardizing existing ecosystems and biological diversity.**Furthermore, many people have expressed ethical or religious concerns about the manipulation of the genetic code. The environmental release of the products of this manipulation worries these critics as well as those who would prefer that “natural” environments be preserved.  
Given these important concerns about genetic engineering, it is perhaps surprising that there is no regulation which specifically controls the release of transgenic fish. In fact, there is no federal legislation exclusively designed to regulate biotechnology. **While a few states have passed laws restricting the release of genetically engineered organisms  (GEOs), little federal regulation covers the release of genetically engineered fish or other animals, and most such regulation to date has occurred under pre-existing federal laws not formulated to address genetic engineering.**The best way to understand the federal regulation of biotechnology is to examine the Coordinated Framework for Regulation of Biotechnology, a document produced by the Office of Science and Technology Policy. The Coordinated Framework, completed in 1986, attempts to clarify how particular activities will be regulated and identifies pertinent statutes and the agencies that administer them, including the Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the National Institutes of Health (NIH), the Food and Drug Administration (FDA), the National Science Foundation (NSF) and the Occupational Safety and Health Administration (OSHA). Under the Framework, these six agencies are instructed to “seek to operate their programs in an integrated and coordinated fashion and together should cover the full range of plants, animals and microorganisms derived by the new genetic engineering techniques.”

#### Studies raise importance of preventing GM fish from entering the wild

Wiley-Blackwell. "Genetically modified Atlantic salmon mating study reveals danger of escape to wild gene pool." ScienceDaily. ScienceDaily, 14 July 2011. <www.sciencedaily.com/releases/2011/07/110713102023.htm>.

**If genetically modified Atlantic salmon were to escape from captivity they could succeed in breeding and passing their genes into the wild**, Canadian researchers have found. Their research, published in *Evolutionary Applications*, explores the potential reproductive implications of GM salmon as they are considered for commercial farming.

"The use of growth-enhancing transgenic technologies has long been of interest to the aquaculture industry and now genetically modified Atlantic salmon is one of the first species to be considered for commercial farming. Yet**, little is known about the potential impact on wild salmon populations if the GM species were to escape captivity**," said lead author Darek Moreau from the Memorial University of Newfoundland, Canada.

**One of the key concerns about a transgene escape is the "Trojan gene effect," caused when a GM fish outcompetes or reproduces equally against wild rivals, however if the resulting offspring are genetically inferior this could lead a species towards eventual extinction**. Until now there is no empirical research to demonstrate the ability of transgenic Atlantic salmon to breed naturally and infiltrate the wild gene pool.

In the wild, reproducing males present two main forms of rivals which any escaping transgenic male would have to compete with; large males which have migrated and returned from the sea and smaller male parr which have matured in freshwater. The large males are aggressive and develop attributes to fight off their rivals, while the smaller male parr use cryptic colouring and 'sneak fertilisation' to compete.

**To measure the ability of transgenic males to compete with wild males during the reproductive season the team monitored breeding behaviour in a naturalised laboratory setting** and used genetic analysis to determine the success of competing individuals at producing offspring.

Large, migratory wild males outperformed their captivity-reared transgenic counterparts in terms of a variety of spawning behaviours. Moreover, despite being less aggressive, non-transgenic male parr were also able to outperform their GM rivals in terms of spawning behaviour, and as a result, achieved higher overall fertilisation success.

"While the transgenic males displayed reduced breeding performance relative to their non-transgenic rivals they still demonstrated the ability to successfully participate in natural spawning events and thus have the potential to contribute modified genes to wild populations," said Moreau. While **the study** provides an estimate of breeding performance under only a single set of physical and demographic environmental conditions, it does mimic a likely invasion scenario where the genetic background of the transgenic population differs from that of the wild population.¶ "Our study **provides the first empirical observations on the natural reproductive capacities of growth hormone transgenic Atlantic salmon**," concluded Moreau. "**While the resulting ecological and genetic effects of a transgene escape remain uncertain, these data highlight the importance of preventing reproductively-viable GM salmon from entering natural system**s."

#### GM fish would destroy ocean ecosystems

Muir 2004, William M., The threats and benefits of GM fish” EMBO reports, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1299107/>, apl

But GM fish, proponents argue, could further ease some of these problems by providing better disease resistance, faster growth and improved food use. Clearly, some modifications aim mainly at increasing the economics of fish farms. Using faster growing fish allows facilities to produce more fish per year with less cost ([Fig 1](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1299107/figure/f1/)). Similarly, cold tolerance would allow farmers to expand aquaculture into colder and less populated areas, such as northern Canada or northern Norway, but would not necessarily improve the environmental impact of aquaculture. Other transgenes are more promising in that respect. Disease resistance would allow farmers to cut down further on antibiotics, insecticides or fungicides. Improved nutrient use would lower the impact of undigested food on the nearby environment. Furthermore, the aim of improving nutrient utilization is to use previously indigestible nutrients, such as phytic acid as a phosphorous source, to further reduce pollution while lowering costs for fish farmers. But no matter which transgene is used, the main benefit would still be to the native species—provided we can keep our farmed fish from escaping—as any improvements in aquaculture would take the pressure away from ocean fisheries.

Opponents, even while acknowledging this argument, believe that **GM fish nevertheless pose a serious threat to wildlife. If GM fish escaped from fish farms, they could further upset the oceans' delicate ecology, causing ecological disruption or species extinction**. Transgenes that increase cold-, salt- or heat-tolerance could allow GM fish to expand into new territories. **GM fish with higher disease resistance and better use of nutrients could outcompete wild relatives and change predator–prey relationships, and they could therefore occupy new ecological niches where wild species would usually not survive**. Finally, **by mating with wild fish, escaped GM fish could spread the transgene among the wild population, which could cause conflicting effects on mating success, viability in natural habitats and other fitness factors required for the species to survive**.

In this light, I would also like to point out that the escape of non-transgenic domesticated fish may cause as great a harm as the escape of GM fish. Domesticated fish have been bred and selected for growth in captivity where predators are kept out and food is abundant, and have thus lost their ability to find food and avoid predators in the wild. If these fish breed with wild fish, their genes may pollute the wild gene pool and cause a general decrease in fitness of the entire population ([Lynch & O'Hely, 2001](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1299107/#b7)). In the worst case—and this may have happened already in some places—the gene pool becomes so polluted that the 'natural' population depends on commercial releases to be viable ([Naylor *et al*, 2001](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1299107/#b16)). This is in contrast to well-managed hatcheries, which try to avoid any artificial selection to circumvent this problem. However, the principal reason for hatchery-based supplementation or restoration programmes is to mitigate habitat loss, which mostly resulted from dam building (and which is why the Bonneville Power Administration shoulders a big part of the US$100 million restoration effort in the Pacific northwest). The second reason was to offset decades of overfishing and keep commercial fishers at work by introducing a surplus of fish.

...GM fish, once escaped into the open ocean, are obviously much harder to control and can spread much faster than GM plants do on land

Clearly, caution is valid, particularly as GM fish, once escaped into the open ocean, are obviously much harder to control and can spread much faster than GM plants do on land. **Even if GM fish are kept only in safe pens, it cannot be ruled out that they might escape due to human error or natural disasters, such as storms that have enough power to destroy fish farms**. But this concern may be overstated because escaped salmon tend to starve before they learn to seek natural prey rather than feed pellets. The first step in assessing whether the potential environmental risk of GM fish would outrank the possible benefits is therefore to develop a reliable and effective risk-assessment methodology. That is actually easier said than done due to the manifold factors that determine whether escaped transgenic animals can cause harm in the wild.

### A2 Biological Control Advantage

#### Biological Pest Control Efforts fail-Could attack non-target species

Simberloff ’96-Daniel Simberloff ,Department of Biological Science, Florida State University, “RISKS OF SPECIES INTRODUCED FOR BIOLOGICAL CONTROL”. http://www.biol.wwu.edu/peterson/Risks%20of%20Biocontrol.pdf

Many early biological control projects used generalized ¶ predators that subsequently attacked non-target species ¶ (Simberloff, 1992). For example, the fish Gambusia 186 D. g ¶ affinis and G. holbrooki, introduced in many regions to ¶ control mosquitoes, have decreased populations of ¶ numerous native fish species through predation, extin- ¶ guishing some in the process (Lloyd, 1990; references in ¶ Simberloff, 1992). Similarly, polyphagous herbivores ¶ introduced to control weeds have affected non-target ¶ native species. Among the most damaging of such introduc¶tions are those of freshwater fishes to attack introduced ¶ aquatic weeds, and some of these have been recent ¶ (Moyle et al., 1986; Courtenay & Williams, 1992; ¶ Courtenay, 1993). Some of these fishes have so greatly ¶ reduced vegetation that native fish community struc- ¶ ture was highly modified, but other possible effects of ¶ these fishes are often unstudied. In every such instance ¶ in which research has been detailed, however effective ¶ the biological control agent was on its target organism, ¶ there was substantial harm to non-target native species. ¶

### Alt Cause-Aquariums

#### Alt cause-Aquariums

Dianna K. Padilla, Professor in the Department of Ecology and Evolution at Stony Brook University and Susan L. Williams, Professor in the Department of Evolution and Ecology at the Bodega Marine Laboratory at UC Davis, 2004, “Beyond Ballast Water: Aquarium and Ornamental Trades as Sources of Invasive Species in Aquatic Ecosystems,” *Frontiers in Ecology and the Environment* Vol. 2, No. 3 (April), pp. 131-138

Here we make the case for increased attention to this threat. At present we do not have all of the data on its full environmental and economic extent, but there are enough examples of aquarium and ornamental escapees that are important invasive species to raise concern. We highlight the tension between sustainable development, intended to support the conservation of biodiversity, and the negative impacts from invasive species. Resolution of this conflict rapidly boils down to a need for future economic analyses. In the meantime, however, we suggest ¶ several relatively easy steps that managers and policy makers can take immediately. ¶ Invasive species are recognized as the second leading ¶ cause of extinctions around the world (Wilcove et al. ¶ 1998). They pose severe ecological and economic threats ¶ as well as danger to human health - for example, the ¶ snail Biomphalaria glabrata carries schistosome parasites ¶ (Ferrari and Hoffman 1992). To date, most attention has ¶ focused on ballast water (Ruiz et al. 1997), including the ¶ proposed reauthorization of the National Invasive ¶ Species Act, which largely ignores other sources of ¶ aquatic invasive species. Ballast water is certainly an ¶ important and controllable vector of potential pests to ¶ harbors and estuaries that are centers of shipping, but it ¶ is not the only threat to aquatic habitats (Figure 4). ¶ Although other avenues of invasion are now receiving ¶ attention (Naylor et al. 2001; Chapman et al. 2003), the ¶ risks from aquarium and ornamental aquatic species ¶ remain below the radar of most agencies responsible for ¶ preventing and managing aquatic invasive species, and ¶ even of concerned scientists. For example, a recent report from the American ¶ Association for the Advancement of Science (Best and ¶ Bornbusch 2001) addressed habitat destruction and ¶ overexploitation during the collection of coral reef organisms for marine aquariums, but ignored the threat ¶ of introduction of non-natives when these species are ¶ transported around the world. As a step forward, the ¶ Working Group on Introduction and Transfers of Marine ¶ Organisms of the International Council on the ¶ Exploration of the Sea (ICES) recently recommended ¶ that the risk from ornamentals and aquarium species ¶ should be evaluated (ICES 2001).

#### Aquariums and ornamental tanks are alt causes

Dianna K. Padilla, Professor in the Department of Ecology and Evolution at Stony Brook University and Susan L. Williams, Professor in the Department of Evolution and Ecology at the Bodega Marine Laboratory at UC Davis, 2004, “Beyond Ballast Water: Aquarium and Ornamental Trades as Sources of Invasive Species in Aquatic Ecosystems,” *Frontiers in Ecology and the Environment* Vol. 2, No. 3 (April), pp. 131-138

Aquarium species are important and beautiful (Figure 5); ¶ however, like species transported in ballast, some pose ¶ extreme threats. Because of their extraordinarily widespread ¶ dispersal to homes and businesses after importation, they ¶ can affect all freshwater and marine habitats. This contrasts ¶ with ballast-transported organisms, which are only released ¶ into ports where ballast water discharge is not regulated. ¶ Organisms transported in ballast water are usually small, ¶ even microscopic, and are often at very young life stages (ie ¶ larvae and spores). Aquarium species, in contrast, are large ¶ and usually traded as adults, which have a greater probability of surviving to reproduce. In addition, good aquarium ¶ animals and plants are hearty, with weaker individuals ¶ (75-85%) being weeded out during collection and trans-portation (Wabnitz et aL 2003). Thus, ¶ although ballast water collects all ¶ species, only species most likely to ¶ survive the harsh conditions associ? ¶ ated with collection and transport ¶ and the broad physiological condi? ¶ tions needed to survive and repro? ¶ duce in aquariums are used in the ¶ aquarium and ornamental industry. ¶ Of all the species with the potential ¶ to establish, aquarium and ornamen? ¶ tal species represent a subset that may ¶ be particularly invasive. ¶ ?

#### More pressing concerns for invasive species than ballast water that the aff doesn’t solve

Dianna K. Padilla, Professor in the Department of Ecology and Evolution at Stony Brook University and Susan L. Williams, Professor in the Department of Evolution and Ecology at the Bodega Marine Laboratory at UC Davis, 2004, “Beyond Ballast Water: Aquarium and Ornamental Trades as Sources of Invasive Species in Aquatic Ecosystems,” *Frontiers in Ecology and the Environment* Vol. 2, No. 3 (April), pp. 131-138

How large a threat?¶ One third of the aquatic species on ¶ the International Union for the ¶ Conservation of Nature (IUCN) ¶ Invasive Species Specialist Group list ¶ of 100 worst invasive species (Lowe et ¶ al. 2000) are from aquarium or orna? ¶ mental releases. At present, over 150 ¶ species of vertebrates, invertebrates, ¶ plants, and microbes (including ¶ pathogens) that have invaded natural ¶ ecosystems have been documented to ¶ come from aquariums and aquatic ¶ ornamental culture (Table 1). The ¶ Figure 3\* A juvenile Uonfish (top). Uonfish are one of the many species of non-native ¶ aquarium fish that are now found in American waters. ¶ vast majority of these are freshwater fish (Figure 6); other ¶ taxa from aquarium and ornamental releases are underesti- ¶ mated (Welcomme 1992). Released aquarium or ornamen? ¶ tal species displace native species (Ceccherelli and Cinelli ¶ 1997), carry pathogens (Stewart 1991), clog waterways ¶ (Schardt 1997), and prey on native species (Table 1), while ¶ others are major agricultural pests (Anderson 1993; Naylor ¶ 1996), and some, like the lionfish, are a direct danger to ¶ humans (Stewart 1991). ¶ The avenues from aquariums to nature include the ¶ dumping of unwanted organisms, escape from tanks and ¶ breeding farms (eg during storms), the drainage of water ¶ containing organisms from tanks, and public aquariums, ¶ and the ritualistic release of species during religious prac? ¶ tices (Severinghaus and Chi 1999). All of these activities ¶ can also release water-borne diseases (Stewart 1991). ¶ Often, well-meaning individuals, unaware of the problem ¶ of introducing non-native species, release unwanted pets, ¶ believing it is more humane to release them than keep ¶ them captive. Increases in the marine aquarium industry, ¶ particularly the trade in "live rock" (whole communities ¶ of animals and plants

### Status Quo/Warming Solves

#### Warming resolves ballast water harms

Frank J. Rahel, Department of Zoology and Physiology, University of Wyoming, and Julian D. Olden, School of Aquatic and Fishery Sciences, University of Washington, 2008, “Assessing the Effects of Climate Change on Aquatic Invasive Species,” Conservation Biology, Volume 22, No. 3

A warmer climate and the resulting effects on precipitation and the amount of snow are projected to increase rates of desiccation and alter the salinity of freshwater and estuary ecosystems. Naturally saline aquatic systems in arid regions such as the southwestern United States will experience increased desiccation and salinization (Seager et. Al. 2007), and saltwater intrusions will occur in some coastal areas (Frederick & Gleick 1999). Altered pathways of Species Introductions Increasing salinization in coastal ecosystems will likely have a strong influence on pathways of species introductions. Many of the recent invasions of the LaurentianGreat Lakes and of the Caspian, Azov, Black, and Baltic seas have resulted from shipping activities, particularly through the release of contaminated ballast water (Carlton & Geller 1993). The primary method used to reduce the spread of non-native species via ballast-water discharge is open-ocean ballast water exchange. Nevertheless, not all shipping companies practice open-ocean exchange, and even if they did, ballast waters would still contain viable propagules that would be released at the port of entry. (*Eirocheir sinensis)*.

#### Warming prevents ballast water harms from escalating

Frank J. Rahel, Department of Zoology and Physiology, University of Wyoming, and Julian D. Olden, School of Aquatic and Fishery Sciences, University of Washington, 2008, “Assessing the Effects of Climate Change on Aquatic Invasive Species,” Conservation Biology, Volume 22, No. 3

Climate change will alter abiotic filters that determine the success of invasive species in aquatic environments (Fig. 2). Most researchers have focused on how climate change will increase the number and severity of invasions, but there may be circumstances in which invasions will be reduced. For example, warmer temperatures and reduced winter hypoxia would expand the pool of invasive species to include warm water or hypoxia-inteolerant species but would reduce the success of coldwater invasive species (Rahel 2002). Such a situation could benefit native species in Patagonian streams, where non native salmonids have restricted native fishes to warm headwater reaches (Pascual et. Al 207). Increasing salinity in estuaries or arid land streams could reduce invasions by non-native species intolerant of saline conditions (Higgins & Wilde 2005). Because native species have evolved adaptations to historical flow regimes, alteration of flow regimes is most likely to benefit non-native species adapated to the changed conditions (Marchetti & Moyle 2001; Olden et. Al 2006). Similarly, conversion of riverine habitat to reservoir habitat will allow a new pool of lentic species to invade, te effects of which could extend for a considerable distance up-and down stream of the reservois (Havel et. Al. 2005).

### Status Quo-Mid-Ocean Solves

Mid-ocean ballast exchange solves ballast water problems now

Smithsonian Environmental Research Center, no date, “Mid Ocean Ballast Water Exchange, Marine Invasions Research Lab, http://www.serc.si.edu/labs/marine\_invasions/vector\_ecology/bw\_exchange.aspx

Since mid-ocean ballast exchange replaces most of the coastal water with open ocean water, it also removes most of the coastal organisms that were originally entrained in the ballast tank. Although oceanic organisms can be captured in ballast water tanks during this exchange, these organisms are considered less likely to become established than biota of coastal origin when discharged into a coastal ecosystems, due to a mismatch among open ocean and coastal habitats (Murphy et al, 2001; Minton et al 2005; Wonham et al, 2001). Conversely, coastal organisms discharged into the ocean are considered less likely to survive in open ocean habitat. ¶ In some cases, replacing low salinity or fresh water with open ocean, high salinity water during ballast water exchange will stress or kill residual coastal organisms. These processes may also reduce the likelihood of successful invasion where water is deballasted.

### Status Quo Solves-International Regulations

#### International regulations solve now

Kathleen Murphy, Marine Invasions Research Laboratory, Smithsonian Environmental Research Center, et. Al, 2004, “Verification of mid-ocean ballast water exchange using naturally occurring coastal tracers,” *Marine Pollution Bulletin* 48 (2004) 711-730

In 1991, the International Maritime Organization (IMO) established voluntary guidelines aimed at minimizing such introductions, requesting that ships perform mid-ocean ballast water exchange (BWE). During BWE, a vessel replaces its original ballast water (taken on board while the vessel was in port or near to the coast) with water from the open ocean. Ballast exchange reduces NIS by (1) discharging a percentage of them into the inhospitable environment of the open ocean, and in some cases, () by increasing the salinity level within the ballast tank to a level such that many species of freshwater or brackish water origins cannot survive (Taylor et. Al, 2002). BWE is now the primary method for reducing the risk of species transfer by ships throughout the world. In the US, BWE is voluntary for most vessels arriving beyond the exclusive economic zone (EEZ), but federal law requires BWE for such vessels entering the Great Lakes and the Hudson River, north of the George Washington Bridge. Regulations have recently been enacted in several states (California, Oregon, Washington) that require BWE for all vessels intending to discharge foreign ballast in their waters. Moreover, the US Coast Guard intends to extend mandatory regulations for BWE to all vessels delivering foreign ballast to any US port. Although other approved ballast water treatment methods may also be used under federal and state laws, no alternatives to BWE have been approved for use to date (see discussion by Taylor et. Al, 2002).

### Status Quo-U.S. Policy Solves

#### Current U.S. law solves

#### Ryan J. Albert, John M. Lishman, and Juhi R. Saxena, all of the U.S. Environmental Protection Agency, Office of Water, 2013, “Ballast water regulations and the move toward concentration-based numeric discharge limits,” Ecological Applications, Vol. 23 Issue 2

United States federal regulation .— At the U.S. federal level, ballast water management is principally addressed by two statutes: (1) the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990, as amended (16 U.S. Code [U.S.C.] §§ 4701 et seq.); and (2) the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act or CWA, 33 U.S.C. §§ 1251 et seq.; see Fig. 1). Both NANPCA and the CWA preserve the authority of the individual U.S. states to more stringently regulate ballast water discharges that occur in their waters (16 U.S.C. § 4725, NANPCA; 33 U.S.C. § 1370, CWA). For the states that currently regulate ballast water discharges, there is substantial variation in their requirements (Table 1).¶ Congress enacted NANPCA in November 1990 (Public Law 101-646; 104 STAT 4761) to authorize the U.S. Coast Guard (USCG) to issue regulations to prevent the introduction and spread of ANS into the Great Lakes through the ballast water of vessels. In 1996, Congress enacted the National Invasive Species Act (NISA), which amended and reauthorized NANPCA (Public Law 104-332; 110 STAT 4073). Among other things, the amendments made by NISA directed the USCG to develop a national ballast water management program for U.S. waters besides the Great Lakes.

### Invasive Species Defense

#### Invasive species threat is overblown

Dana Joel Gattuso, senior fellow at the National Center for Public Policy Research, “Invasive Species: Animal, Vegetable, or Political,”2006, National Policy Analysis, August #544, http://www.nationalcenter.org/NPA544InvasiveSpecies.html

What do mute swans, kudzu, red clover, pigs, and starlings have in common? Not much, except that they are all non-indigenous species - that is, the species does not originate from within the United States.¶ And that is essentially all they have in common. Yet many government agencies, lawmakers and environmental special-interest groups would like to clump together the thousands of these species introduced within our borders and stamp out their existence. More than 50 bills are pending in the U.S. Congress to address so called "invasive species."1 Most bills would expand federal authority to further control land use and authorize billions of tax dollars to eradicate non-native flora and fauna.¶ Some "exotic species" are problematic, overtaking other species and imposing large economic costs in damages. But, contrary to public perception, these are more the exception than the rule. Most non-native species adapt to their surroundings, and many are even useful.¶

#### Invasive species are not a threat to biodiversity

Dana Joel Gattuso, senior fellow at the National Center for Public Policy Research, “Invasive Species: Animal, Vegetable, or Political,”2006, National Policy Analysis, August #544, http://www.nationalcenter.org/NPA544InvasiveSpecies.html

Threat to Biodiversity?¶ Among the exaggerated claims regarding non-indigenous species is their alleged threat to the variety of species within ecosystems. According to Defenders of Wildlife, "The spread of non-native or 'exotic' species has emerged in recent years as one of the most serious threats to biodiversity, undermining the ecological integrity of many native habitats and pushing some rare species to the edge of extinction." The Nature Conservancy lists invasives second, just after species' habitat loss, as the biggest danger to biodiversity.26¶ To be sure, there are cases where exotic species have eliminated local flora and fauna, out-competing them for food, oxygen or sunlight; the same can be said of some resilient native species too. But there is no scientific evidence of actual global extinction caused by a non-native species. Nor do exotic species threaten species "richness" or "biodiversity." ¶ In fact, some scientists believe non-natives enhance diversity. According to Michael Rosenzweig, a biologist at the University of Arizona and the editor of Evolutionary Ecology Research, the presence of exotic species can actually lead over time to a greater number of species because the destruction of local species would allow for the introduction of new species.28 Similarly, evolutionary biologist Gereet Vermeij wrote in Science, "Invasion usually results in the enrichment of biotas [plant and animal life of a particular region] of continents and oceans. In some biotas... interchange has pushed diversity to levels higher than the pre-extinction number of species."29¶

### Current Policy Solves

Current policy and individual actions solve

Smithsonian Institution, 2012, “Reducing the Risk of Transporting Invasive Species,” http://ocean.si.edu/ocean-news/reducing-risk-transporting-invasive-species

Sometimes small, simple steps can go a long way toward solving big problems. Ship captains can help prevent many stow-away species from invading new areas simply by flushing and refilling ballast tanks with water from the open ocean before they arrive in port. In deep water far from the coast, animals flushed out of the ship's tanks are not likely to survive. Similarly, any deep-water organisms brought on board in the new batch of water, are not likely to make a home in shallow coastal waters at the ship's next port. ¶ Scientists have found that this technique can remove more than 90 percent of the tiny animals in ballast tanks. The U.S. and others countries have begun requiring ships to either keep their ballast water on board or flush it thoroughly in deep waters far from the coast. Meanwhile, scientists at the Smithsonian Environmental Research Center and elsewhere are busy studying other techniques, such filtering or treating ballast water with UV light or heat. They hope that down the line, these techniques will put an end to high-seas hitchhiking altogether.

#### Current policy solves

**Barbara Wilcox,** USGS, **2013** “USGS Targets Tiny Stowaways in Ships’ Ballast Water,” http://www.usgs.gov/blogs/features/usgs\_top\_story/usgs-targets-tiny-stowaways-in-ships-ballast-water/

It’s almost always too late to get rid of such pests once they are established. It’s much easier to stop aquatic species from becoming introduced by treating incoming ballast water before it is discharged into unfamiliar waters. For several decades, state and federal governments and the International Maritime Organization have been crafting requirements for treatment of ships’ ballast water. These standards could be implemented worldwide by 2020, but key to global adoption is having consistent, reliable and easily followed standards and methodologies. USGS scientists are evaluating both risk-based and quantitative ballast-water discharge standards to protect marine ecology. In partnership with the National Park Service and private firms, USGS is developing emergency ballast-water treatment systems and freshwater ballast treatment systems that are safe and effective while also being cost-efficient and easy to use. Finally, USGS has co-produced with the U.S. Environmental Protection Agency the first large-scale comparative atlas of non-native marine species in the North Pacific, giving resource managers data with which to strategize against a possible threat.

#### Current legislation prevents ballast water harms

Ryan J. Albert, John M. Lishman, and Juhi R. Saxena, all of the U.S. Environmental Protection Agency, Office of Water, 2013, “Ballast water regulations and the move toward concentration-based numeric discharge limits,” Ecological Applications, Vol. 23 Issue 2

The USCG ballast water management requirements specific to the Great Lakes are codified in regulations at 33 U.S. Code of Federal Regulations [C.F.R.] Part 151, Subpart C, and the requirements applicable to all U.S. waters are codified at 33 C.F.R. Part 151, Subpart D. As initially issued, both sets of regulations were consistent with the existing ballast water management resolutions adopted by IMO and placed primary emphasis on use of mid-ocean BWE to manage ballast water. Recognizing the significant limitations of a BWE-based regulatory framework, the USCG issued for public comment a proposed rule in August 2009 to gradually replace reliance on BWE with a regime requiring treatment of ballast water to meet a concentration-based discharge standard. The initial USCG proposed rule would first have required ballast water discharges to meet a standard consistent with the BWM Convention's Regulation D-2 standard (referred to in the USCG proposal as the “Phase 1” standard). The proposed rule would have subsequently required compliance with a discharge standard 1000 times more stringent than Phase 1 for the two larger size classes of organisms (the “Phase 2” standard) (74 Federal Register 44632).

### State Legislation Solves Now

#### State legislation solves ballast water issues in the status quo

Ryan J. Albert, John M. Lishman, and Juhi R. Saxena, all of the U.S. Environmental Protection Agency, Office of Water, 2013, “Ballast water regulations and the move toward concentration-based numeric discharge limits,” Ecological Applications, Vol. 23 Issue 2

¶ United States regulation by individual states .— Four U.S. states (California, Michigan, Minnesota, and Wisconsin) have independent laws, regulations, or permits establishing numeric ballast water discharge standards or treatment requirements. Four other states without specific ballast water related laws have included numeric ballast water discharge limits as part of their Clean Water Act (CWA) section 401 certifications of the VGP (Illinois, Indiana, Ohio, and New York); a fifth state, Pennsylvania, included those conditions but subsequently deleted them in November 2010. See Table 1 for a list of U.S. state standards.¶ Under CWA section 401, when the U.S. federal government issues a permit such as the VGP, it must seek certification from the state in which the discharge originates (i.e., the location(s) where the ballast water is discharged) to ensure that the discharge will comply with the applicable provisions of the CWA, including water quality standards, and other appropriate requirements of state law. As a result, the VGP contains a number of section CWA 401 certifications with ballast water-related conditions, which vary in their stringency, schedules for implementation, and types of vessels covered (Table 1). By way of example, we briefly discuss three states' concentration-based standards for organisms in ballast discharge and summarize their publicly stated rationale.

#### Multiple state regulations in place-No federal action necessary

Ryan J. Albert, John M. Lishman, and Juhi R. Saxena, all of the U.S. Environmental Protection Agency, Office of Water, 2013, “Ballast water regulations and the move toward concentration-based numeric discharge limits,” Ecological Applications, Vol. 23 Issue 2

California enacted legislation establishing ballast water discharge standards for state waters and a schedule for compliance with those standards based on recommendations of the California State Lands Commission in order to “approach a protective zero discharge standard” (CSLC 2010, Dobroski et al. 2011). The interim standard (those in force starting in 2010) for organisms greater than 50 μm is zero detectable living organisms, and for organisms between 10 and 50 μm is less than 0.01 organisms/mL. Final standards, currently set to start in 2020, are zero detectable organisms for all size classes of organisms, including viruses and bacteria (Table 1). California also included these standards in its CWA section 401 certification of the VGP by reference.¶ New York's mechanism for regulating ballast water discharges is through its CWA section 401 certification of the VGP. As part of its certification, the New York Department of Environmental Conservation (DEC) requires, for vessels constructed on or after 1 January 2013, the same concentrations as California's interim standards for organisms greater than or equal to 50 μm (zero detectable living organisms) and organisms between 10 and 50 μm (less than 0.01 living organisms/mL). In its certification, New York stated that the IMO standards “are not sufficiently protective” and more stringent concentration-based standards were necessary to “prevent further impairment of the state's water quality” (New York 2008). Due to implementation difficulties and other factors, New York extended the compliance date until the end of the VGP's five-year term (J. M. Tierney, unpublished letter). As part of the VGP five-year renewal, the state is currently evaluating what, if any, conditions to apply to the next issuance of the VGP; however, as of 31 July 2012, New York has not proposed conditions similar in stringency to those contained in their 2008 certification.¶ In 2008, the Minnesota Pollution Control Agency (MPCA), under Minnesota state law, issued a State Disposal System (SDS) permit for ballast water discharges into Minnesota waters. According to MPCA, the discharge standards contained in the permit “are based on the Performance Standards contained in Section D-2 of the BWM Convention, with the exception of the standard for Vibrio cholerae. The general permit does not include a limit on Vibrio cholerae because analytical methods to enumerate that organism in ballast water have not been validated” (Minnesota Pollution Control Agency 2008).

### International Agreements Solve

#### International agreements and private research solves

Barbara Werschkun, Federal Institute for Risk Assessment, Berlin, Germany, 2012 “Ballast Water: Challenges for Consumer Protection, Activities, and Cooperations, *Emerging Risks from Ballast Water Treatment*, Federal Institute for Risk Assessment

The Ballast Water Management Convention, adopted by the international community in 2004, is expected to enter into force within the next one or two years. From then on, more than 50,000 ships world wide will have to be equipped with on-board installations for ballast water treatment to meet the requirements of the Convention for the maximum number of living organisms in ballast water upon discharge. From the point of view of health protection, both treated and untreated ballast water may be associated with potential hazards to human health. On the one hand, the spread of human pathogens or toxin-producing algae may pose direct threats to biological safety and safety in the food chain. On the other hand, the envisaged countermeasures of biocidal treatment may lead to new risks with regard to chemical safety-not only from the use of chemicals and the generation of by-products on board the ships themselves, but also from the release of these substances into fishing waters or recreational areas. With these challenges in mind, BfR scientists over the years have contributed to the international efforts directed at the ballast water problem in various ways: Within the setting of the Ballast Water Management Convention, the BfR has evaluated many application documents for the approval of ballast water management systems with regard to their human health risks and has continuously contributed to the development and improvement of international guidelines within the bodies of the International Maritime Organization. Based on insights from the regulatory risk assessment and the identification of open questions, the BfR initiated its own research activities both in the office and in the laboratory, with particular focus on the formation of hazardous disinfection by-products and the exposure of humans to hazardous substances from ballast water management systems.

## A2 Disease Add On-Defense

Disease burns out before it can cause extinction – lethal viruses will kill their hosts too fast.

Understanding Evolution 7 (Website on Evolution from UC Berkeley, "Evolution from a virus's view," December, http://evolution.berkeley.edu/evolibrary/news/071201\_adenovirus)

Since transmission is a matter of life or death for pathogen lineages, some evolutionary biologists have focused on this as the key to understanding why some have evolved into killers and others cause no worse than the sniffles. The idea is that there may be an evolutionary trade-off between virulence and transmission. Consider a virus that exploits its human host more than most and so produces more offspring than most. This virus does a lot of damage to the host — in other words, is highly virulent. From the virus's perspective, this would, at first, seem like a good thing; extra resources mean extra offspring, which generally means high evolutionary fitness. However, if the viral reproduction completely incapacitates the host, the whole strategy could backfire: the illness might prevent the host from going out and coming into contact with new hosts that the virus could jump to. A victim of its own success, the viral lineage could go extinct and become an evolutionary dead end. This level of virulence is clearly not a good thing from the virus's perspective.

No impact – diseases evolve to be more mild and humans evolve past vulnerabilities.

Achenbach 3 (Joel, Washington Post Staff Writer, "Our Friend, the Plague," Nov, http://ngm.nationalgeographic.com/ngm/0311/resources\_who.html)

Whenever a new disease appears somewhere on our planet, experts invariably pop up on TV with grave summations of the problem, usually along the lines of, "We're in a war against the microbes"—pause for dramatic effect —"and the microbes are winning." War, however, is a ridiculously overused metaphor and probably should be bombed back to the Stone Age. Paul Ewald, a biologist at the University of Louisville, advocates a different approach to lethal microbes. Forget trying to obliterate them, he says, and focus instead on how they co-evolve with humans. Make them mutate in the right direction. Get the powers of evolution on our side. Disease organisms can, in fact, become less virulent over time. When it was first recognized in Europe around 1495, syphilis killed its human hosts within months. The quick progression of the disease—from infection to death—limited the ability of syphilis to spread. So a new form evolved, one that gave carriers years to infect others. For the same reason, the common cold has become less dangerous. Milder strains of the virus—spread by people out and about, touching things, and shaking hands—have an evolutionary advantage over more debilitating strains. You can't spread a cold very easily if you're incapable of rolling out of bed. This process has already weakened all but one virulent strain of malaria: Plasmodium falciparum succeeds in part because bedridden victims of the disease are more vulnerable to mosquitoes that carry and transmit the parasite. To mitigate malaria, the secret is to improve housing conditions. If people put screens on doors and windows, and use bed nets, it creates an evolutionary incentive for Plasmodium falciparum to become milder and self-limiting. Immobilized people protected by nets and screens can't easily spread the parasite, so evolution would favor forms that let infected people walk around and get bitten by mosquitoes. There are also a few high-tech tricks for nudging microbes in the right evolutionary direction. One company, called MedImmune, has created a flu vaccine using a modified influenza virus that thrives at 77°F instead of 98.6°F, the normal human body temperature. The vaccine can be sprayed in a person's nose, where the virus survives in the cool nasal passages but not in the hot lungs or elsewhere in the body. The immune system produces antibodies that make the person better prepared for most normal, nasty influenza bugs. Maybe someday we'll barely notice when we get colonized by disease organisms. We'll have co-opted them. They'll be like in-laws, a little annoying but tolerable. If a friend sees us sniffling, we'll just say, Oh, it's nothing—just a touch of plague.

## A2 Food Security Advantage\*\*\*Borrowed from Aquaculture starter pack file

### 1nc Food Security Impact

#### Food security improving now

Financial Times, 5/28 (“Boost for global food security,” 5/28/2014, <http://blogs.ft.com/the-world/2014/05/boost-for-global-food-security/>, JMP)

Some good news for a change. Food security - the availability and affordability of food – has got better, according to research published on Wednesday.

The 66-page report from the Economist Intelligence Unit, sponsored by DuPont, the chemicals company, found that despite last year’s freak weather patterns - drought in California, heatwaves in Australia and floods in Russia – food security improved in almost three-quarters of the world’s countries.

Food security is a growing concern, given the expectation that the world’s population is likely to peak at 10bn mid-century, meaning an extra 3bn mouths to feed.

The biggest improvements were in countries with the worst food security problems, namely sub-Saharan Africa, where only two – South Africa and Botswana – have a global food security index of more than 50 per cent.

This has led to a narrowing of the gap with the most food-secure countries – headed by the US – where improvements were slower.

Lower wheat and rice prices were behind the improvement, as was a better world economy. The EIU report backs up the Food and Agriculture Organisation’s recent research showing a fall in the number of hungry people from 868m in 2010-12 to 842m – still 12 per cent of the global population.

#### Food insecurity empirically doesn’t cause conflict

Salehyan 7 – Professor of Political Science at the University of North Texas. (Idean, 6-14 “The New Myth About Climate Change Corrupt, tyrannical governments—not changes in the Earth’s climate—will be to blame for the coming resource wars.” <http://www.foreignpolicy.com/articles/2007/08/13/the_new_myth_about_climate_change>)

First, aside from a few anecdotes, there is little systematic empirical evidence that resource scarcity and changing environmental conditions lead to conflict. In fact, several studies have shown that an abundance of natural resources is more likely to contribute to conflict. Moreover, even as the planet has warmed, the number of civil wars and insurgencies has decreased dramatically. Data collected by researchers at Uppsala University and the International Peace Research Institute, Oslo shows a steep decline in the number of armed conflicts around the world. Between 1989 and 2002, some 100 armed conflicts came to an end, including the wars in Mozambique, Nicaragua, and Cambodia. If global warming causes conflict, we should not be witnessing this downward trend. Furthermore, if famine and drought led to the crisis in Darfur, why have scores of environmental catastrophes failed to set off armed conflict elsewhere? For instance, the U.N. World Food Programme warns that 5 million people in Malawi have been experiencing chronic food shortages for several years. But famine-wracked Malawi has yet to experience a major civil war. Similarly, the Asian tsunami in 2004 killed hundreds of thousands of people, generated millions of environmental refugees, and led to severe shortages of shelter, food, clean water, and electricity. Yet the tsunami, one of the most extreme catastrophes in recent history, did not lead to an outbreak of resource wars. Clearly then, there is much more to armed conflict than resource scarcity and natural disasters.

#### Wars are mostly regional – won’t escalate internationally

Allouche 11 – fellow at the Institute of Development Studies at Brighton, UK (Jeremy, "The sustainability and resilience of global water and food systems: Political analysis of the interplay between security, resource scarcity, political systems and global trade" Food Policy, Volume 36, Supplement 1)

This article has provided an overview of the current and future challenges in terms of global food and water systems. The major focus of the argument has been on how resource scarcity is a contested and subjective concept which cannot fully explain conflict, political instability or food insecurity. The politics of inequality and allocation are much more important variables in explaining water and food insecurity. This is particularly true for conflicts. Although resource scarcity has been linked to international wars, the current data shows that most conflict over water and food are much more local. But there again, although resource scarcity can be linked to malnutrition, hunger and water insecurity, in the majority of cases, water and food insecurity are rarely about competition over resources but rather reflect the politics of allocation and inequality. In this respect, war and conflicts aggravate these insecurities not just on the short term but also on the long term. At the global level, food security has considerably improved and provides the means to address these insecurities. Trade can certainly be seen as a way to address access for countries that are under severe stress in terms of food and water and provides logical grounds for questioning the various water and food wars scenarios. Although global trade and technological innovation are key drivers in providing stable and resilient global systems, the most destabilizing global water-related threat is increasing food prices and hunger. Overall, decision-makers should show greater concern for the human beings who make their living in agriculture, so that those at risk of livelihood and food-security failures, especially under anticipated scenarios of climate change, will be less deprived. Current debates linked to global food security and climate fail to address the political dimension of resource scarcity which is primarily linked to the politics of inequality, gender and power.

### --- XT: Food Security Improving Now

#### Food security improving now

Dupont, 5/28 (“Global Food Security Index Improves,” 5/28/2014, <http://nationalhogfarmer.com/environment/global-food-security-index-improves>, JMP)

The question of global food security is significant, but a new report from the Economist Intelligence Unit (EIU) sponsored by DuPont offers improving grades on an important report card. The 2014 Global Food Security Index shows that 70 percent of countries in the study saw food security scores rise over the previous year.

This index, which measures 28 different food security indicators, looks at the issue for 109 countries. Craig F. Binetti, president, DuPont Nutrition and Health, comments: "The index provides a common set of metrics that enable us to track progress in food security globally, and the outcomes thus far are promising. But we know it will take continued collaboration, innovation and investment in agriculture, food and nutrition to overcome the vast challenges to feeding the world's growing population."

With the prospect of feeding 9 billion people by 2050, food security is a global issue. Food prices are a key factor impacting security, with many in the developing world already spend half to three-quarters of their income on food. Rising worries over water availability and access to arable land, add to the food security challenge.

The index showed that every region improved from the prior year, but most progress was seen in Sub-Saharan Africa, driven primarily by improved political stability and economic growth, despite the food-insecure-environment. The index slid for Central and South America and Asia Pacific as diet diversification fell and there was a decline in public spending on agricultural research.

In developing countries, the index shows the key challenges include inadequate infrastructure, political risk and food price inflation. For developed countries, the challenges include adapting to urbanization and the continued rise of obesity.

### --- XT: Food Security Impact Answers

#### Their neo-Malthusian claims are false – food scarcity doesn’t cause war

Allouche 11 – fellow at the Institute of Development Studies at Brighton, UK (Jeremy, "The sustainability and resilience of global water and food systems: Political analysis of the interplay between security, resource scarcity, political systems and global trade" Food Policy, Volume 36, Supplement 1)

The question of resource scarcity has led to many debates on whether scarcity (whether of food or water) will lead to conflict and war. The underlining reasoning behind most of these discourses over food and water wars comes from the Malthusian belief that there is an imbalance between the economic availability of natural resources and population growth since while food production grows linearly, population increases exponentially. Following this reasoning, neo-Malthusians claim that finite natural resources place a strict limit on the growth of human population and aggregate consumption; if these limits are exceeded, social breakdown, conflict and wars result. Nonetheless, it seems that most empirical studies do not support any of these neo-Malthusian arguments. Technological change and greater inputs of capital have dramatically increased labour productivity in agriculture. More generally, the neo-Malthusian view has suffered because during the last two centuries humankind has breached many resource barriers that seemed unchallengeable. Lessons from history: alarmist scenarios, resource wars and international relations In a so-called age of uncertainty, a number of alarmist scenarios have linked the increasing use of water resources and food insecurity with wars. The idea of water wars (perhaps more than food wars) is a dominant discourse in the media (see for example Smith, 2009), NGOs (International Alert, 2007) and within international organizations (UNEP, 2007). In 2007, UN Secretary General Ban Ki-moon declared that ‘water scarcity threatens economic and social gains and is a potent fuel for wars and conflict’ (Lewis, 2007). Of course, this type of discourse has an instrumental purpose; security and conflict are here used for raising water/food as key policy priorities at the international level. In the Middle East, presidents, prime ministers and foreign ministers have also used this bellicose rhetoric. Boutrous Boutros-Gali said; ‘the next war in the Middle East will be over water, not politics’ (Boutros Boutros-Gali in Butts, 1997, p. 65). The question is not whether the sharing of transboundary water sparks political tension and alarmist declaration, but rather to what extent water has been a principal factor in international conflicts. The evidence seems quite weak. Whether by president Sadat in Egypt or King Hussein in Jordan, none of these declarations have been followed up by military action**.** The governance of transboundary water has gained increased attention these last decades. This has a direct impact on the global food system as water allocation agreements determine the amount of water that can used for irrigated agriculture. The likelihood of conflicts over water is an important parameter to consider in assessing the stability, sustainability and resilience of global food systems. None of the various and extensive databases on the causes of war show water as a casus belli. Using the International Crisis Behavior (ICB) data set and supplementary data from the University of Alabama on water conflicts, Hewitt, Wolf and Hammer found only seven disputes where water seems to have been at least a partial cause for conflict (Wolf, 1998, p. 251). In fact, about 80% of the incidents relating to water were limited purely to governmental rhetoric intended for the electorate (Otchet, 2001, p. 18). As shown in The Basins At Risk (BAR) water event database, more than two-thirds of over 1800 water-related ‘events’ fall on the ‘cooperative’ scale (Yoffe et al., 2003). Indeed, if one takes into account a much longer period, the following figures clearly demonstrate this argument. According to studies by the United Nations Food and Agriculture Organization (FAO), organized political bodies signed between the year 805 and 1984 more than 3600 water-related treaties, and approximately 300 treaties dealing with water management or allocations in international basins have been negotiated since 1945 ([FAO, 1978] and [FAO, 1984]). The fear around water wars have been driven by a Malthusian outlook which equates scarcity with violence, conflict and war. There is however no direct correlation between water scarcity and transboundary conflict. Most specialists now tend to agree that the major issue is not scarcity per se but rather the allocation of water resources between the different riparian states (see for example [Allouche, 2005], [Allouche, 2007] and [Rouyer, 2000]). Water rich countries have been involved in a number of disputes with other relatively water rich countries (see for example India/Pakistan or Brazil/Argentina). The perception of each state’s estimated water needs really constitutes the core issue in transboundary water relations. Indeed, whether this scarcity exists or not in reality, perceptions of the amount of available water shapes people’s attitude towards the environment (Ohlsson, 1999). In fact, some water experts have argued that scarcity drives the process of co-operation among riparians ([Dinar and Dinar, 2005] and [Brochmann and Gleditsch, 2006]). In terms of international relations, the threat of water wars due to increasing scarcity does not make much sense in the light of the recent historical record. Overall, the water war rationale expects conflict to occur over water, and appears to suggest that violence is a viable means of securing national water supplies, an argument which is highly contestable. The debates over the likely impacts of climate change have again popularised the idea of water wars. The argument runs that climate change will precipitate worsening ecological conditions contributing to resource scarcities, social breakdown, institutional failure, mass migrations and in turn cause greater political instability and conflict ([Brauch, 2002] and Pervis and Busby, 2004 Pervis, Nigel, Busby, Joshua, 2004. The Security Implications of Climate Change for the UN System. Environmental Change and Security Project Report 10, pp. 67–73.[Pervis and Busby, 2004]). In a report for the US Department of Defense, Schwartz and Randall (2003) speculate about the consequences of a worst-case climate change scenario arguing that water shortages will lead to aggressive wars (Schwartz and Randall, 2003, p. 15). Despite growing concern that climate change will lead to instability and violent conflict, the evidence base to substantiate the connections is thin ([Barnett and Adger, 2007] and [Kevane and Gray, 2008]).

#### War causes resource scarcity – not the other way around

Allouche 11 – fellow at the Institute of Development Studies at Brighton, UK (Jeremy, "The sustainability and resilience of global water and food systems: Political analysis of the interplay between security, resource scarcity, political systems and global trade" Food Policy, Volume 36, Supplement 1)

Armed conflict is the main cause of emergency food insecurity in the world today (FAO, 2000) and, hunger is routinely used as a weapon or a political tool during conflicts. In Ethiopia for example, the government attempted to deny food to rebel forces and their supporters – livestock, farms and food stores in Tigre and Eritrea were systematically bombed (Keller, 1992, p. 620). More generally, it has been estimated that approximately 24 million people in 28 countries across the world are hungry and in need of humanitarian assistance due to war (Messer et al., 2001). The most affected people are usually refugees and internally displaced persons of which women and children are a large majority. The impact of armed conflict on food production and food availability is important especially in the African context where most people earn at least a part of their livelihood through agriculture or livestock keeping. One study estimated that food production in 13 war-torn countries of Sub-Saharan Africa during 1970–1994 was on average 12.3% lower in war years compared to peace adjusted values (Messer et al., 1998). In another study covering all developing countries the FAO estimated that from 1970 to 1997 conflict induced losses of agricultural output totalled $121 billion in real terms (or an average of $4.3 billion annually) (FAO, 2000). These impacts are not just on food production but there is also a devastating human dimension in terms of hunger and malnutrition. So far the emphasis has been on the impacts of armed conflict on food security but there is also an important post-conflict dimension. A number of studies have shown how violent conflict in Africa plays a decisive role in the creation of conditions leading to famine ([De Waal, 1990], [De Waal, 1993] and [Macrae and Zwi, 1994]), and point to the changing nature of the relationship between conflict and vulnerability to famine. As highlighted by a recent FAO study (2008), food shortages linked to conflict set the stage for years of long-term food emergencies, continuing well after fighting has ceased. These situations can be characterized as chronic entitlement failures where communities, households and individuals who have had their assets stripped through conflict, lack the income and livelihood resources to access food and assure their food security, even where food is available (see Macrae and Zwi, 1994). The impact of war on water is also a serious issue. Ensuring safe water and decent sanitation for civilians in conflict zones is crucial in the sense that diseases have an even large impact in terms of mortality than military casualties during conflicts. The provision of water and sanitation is of utmost priority in post-conflict states. Unsafe water equates directly with poor health, but the lack of adequate public revenues, government capacity, and investor interest often results in failure to re-establish access to basic infrastructural services (Allouche, 2010). Overall, it seems clear that perceived resource scarcity is not an adequate explanation for war at the international level. At the national level, water and food insecurity are relatively important factors in the causes of civil wars. At the local level, water scarcity and food insecurity may lead to local political instability and sometimes violent forms of conflict. Armed conflict creates situation of emergency food and water insecurity and has a long-term impact on post-conflict societies. In the near future, it seems that despite climate change, international resource wars are unlikely and resource allocation will be settled through diplomatic negotiation and perhaps most importantly international trade as will be discussed in the next section.

#### No risk of resource wars

Pinker 11—Harvard College Professor, Johnstone Family Professor in the Department of Psychology at Harvard University (Steven, © 2011, The Better Angels of our Nature: Why Violence has Declined, RBatra)

Once again it seems to me that the appropriate response is “maybe, but maybe not.” Though climate change can cause plenty of misery and deserves to be mitigated for that reason alone, **it will not necessarily lead to armed conflict**. The political scientists who track war and peace, such as Halvard Buhaug, Idean Salehyan, Ole Theisen, and Nils Gleditsch, are skeptical of the popular idea that people fight wars over scarce resources.290 Hunger and resource shortages are tragically common in sub-Saharan countries such as Malawi, Zambia, and Tanzania, but wars involving them are not. Hurricanes, floods, droughts, and tsunamis (such as the disastrous one in the Indian Ocean in 2004) do not generally lead to armed conflict. The American dust bowl in the 1930s, to take another example, caused plenty of deprivation but no civil war. And while temperatures have been rising steadily in Africa during the past fifteen years, civil wars and war deaths have been falling. Pressures on access to land and water can certainly cause **local skirmishes, but a genuine war requires that hostile forces be organized and armed**, and that depends more on the influence of bad governments, closed economies, and militant ideologies than on the sheer availability of land and water. Certainly any connection to terrorism is in the imagination of the terror warriors: terrorists tend to be underemployed lower-middle-class men, not subsistence farmers.291 As for genocide, the Sudanese government finds it convenient to blame violence in Darfur on desertification, distracting the world from its own role in tolerating or encouraging the ethnic cleansing.

In a regression analysis on armed conflicts from 1980 to 1992, Theisen found that conflict was more likely if a country was poor, populous, politically unstable, and abundant in oil, but not if it had suffered from droughts, water shortages, or mild land degradation. (Severe land degradation did have a small effect.) Reviewing analyses that examined a large number (N) of countries **rather than cherry-picking one or two**, he concluded, “**Those who foresee doom, because of the relationship between resource scarcity and violent internal conflict, have very little support in the large-N literature**.” Salehyan adds that relatively inexpensive advances in water use and agricultural practices in the developing world can yield massive increases in productivity with a constant or even shrinking amount of land, and that better governance can mitigate the human costs of environmental damage, as it does in developed democracies. Since the state of the environment is at most one ingredient in a mixture that depends far more on political and social organization, resource wars are far from inevitable, even in a climate-changed world.

## Solvency

#### Even if the aff DID solve-The timeframe is wayyyy too long

Sharp '10 (Leah Sharp, writer for the Minnesota Sea Grant, "Genetic Biocontrol – The Future of Managing Invasive Fish?", http://www.seagrant.umn.edu/newsletter/2010/12/genetic\_biocontrol\_the\_future\_of\_managing\_invasive\_fish.html, ST)

The top five concerns are: 1. Costs, 2. The genetic preservation of native species, 3. Unintended consequences, 4. The uncontrollability of released organisms, and 5. Diverting resources from other needs. The exciting potential these methods offered was tempered by the fact that most are far from field-ready. Keenly aware that mobile, reproducing organisms would be difficult…if not impossible…to recapture, symposium participants discussed the risks associated with setting genetically modified organisms loose in the environment. Formerly with Sea Grant, Anne Kapuscinski, Sherman Fairchild Distinguished Professor of Sustainability Science at Dartmouth College, addressed "environmental risk assessment." Keith Hayes, CSIRO Australia, helped shed light on how to incorporate the uncertainty inherent in this new technology into quantitative calculations, a crucial step in determining the risks associated with the use of genetically modified organisms in the wild. Discussions about the murky regulatory arena across state, federal, and international jurisdictions dominated the discussions on the third day of the symposium. Representatives from the U.S. Food and Drug Administration, the U.S. Fish and Wildlife Service, the Cartagena Protocol on Biosafety, and others talked about the perspectives of their various agencies on the use and regulation of genetic biocontrol technology. While it remained unclear what roles the various agencies would play, all agreed that working together is key to developing an effective regulatory process. Post-symposium, teams of participants began writing synthesis papers focused on research needs associated with the technology, environmental risk assessment, and regulations and policy. Academic articles resulting from the symposium will be published in the journal Biological Invasions. Presentations from the symposium and the focus groups preceding the symposium are posted on the Minnesota Sea Grant Web site at: [www.seagrant.umn.edu/ais/biocontrol](http://www.seagrant.umn.edu/ais/biocontrol). Many sponsors made the International Symposium on Genetic Biocontrol of Invasive Fish possible; including the U.S. Fish and Wildlife Service, Minnesota Sea Grant, the Great Lakes Protection Fund, Dartmouth College, the U.S. Department of the Interior Bureau of Reclamation, and the Murray- Darling Basin Authority.

## CP Stuff

### Do it on Land CP

\*\*\*Combine with the CP stuff from the aquaculture neg

#### Transgenic fish must be bred on land.

University of Gothenburg. "Risks Involved With Transgenic Fish." ScienceDaily. ScienceDaily, 1 September 2009. <www.sciencedaily.com/releases/2009/08/090827073250.htm>.

**Fast growing transgenic fish can revolutionise commercial fish farming and relieve the pressure on overexploited fish stocks. But what happens in the natural environment if transgenic fish escape?** Researchers at the University of Gothenburg have studied transgenic fish on behalf of the EU and are urging caution: "**Until further notice transgenic fish should be bred in closed systems on land," says Fredrik Sundström at the Department of Zoology, University of Gothenburg, Sweden.** By furnishing fish with genes from other organisms, so-called transgenes, **researchers have succeeded in producing fish that grow considerably faster or are more resistant to diseases**. **Fish can also be modified to cope better with cold, which facilitates breeding in colder conditions. There are major benefits for commercial fish farming as transgenic fish are expected to deliver higher production and better yields**. However, transgenic fish can also entail risks and undesirable effects on the natural environment. **More resistant to toxins** For example, transgenic fish can be more resistant to environmental toxins, which could entail the accumulation of toxins that ultimately end up in consumers. There are also misgivings that the higher level of growth hormone in the fish can affect people. Researchers at the University of Gothenburg have therefore been commissioned by the EU to study the environmental effects of GMO (genetically modified organisms) within fish farming. The results of the studies show that the genetically modified fish should be treated with great care. **Simulated escapes** Sundström, PhD at the Department of Zoology, has studied transgenic salmon and rainbow trout to ascertain what ecological risks they might constitute for the natural environment. The study, which **simulated escapes in a laboratory environment, shows that transgenic fish have a considerably greater effect on the natural environment than hatchery-reared non-transgenic fish when they escape**. For example, **genetically modified fish survive better when there is a shortage of food, and benefit more than non-transgenic fish from increasing water temperatures.** "It is probably due to the fact that genetically modified fish have a greater ability to compete and are better at converting food," says Sundström. **Natural breeds are under threat** **If transgenic fish become established in natural stocks they would be able to outcompete the natural breeds**. However, conducting studies in a laboratory environment that imitates nature is complicated, which makes it difficult to predict how escaped transgenic fish affect the natural environment. Sundström's conclusion is that international consensus is required before commercial farming can be permitted, and that a precautionary principle must be applied. "One option is to farm the transgenic fish on land, which would make escape impossible. At least fertile fish should be kept in a closed system," says Sundström. As of yet no country has permitted commercial farming of transgenic fish, but several applications for such operations are under consideration by authorities in both the USA and the EU.

### CBD CP

#### CBD solves best and has authority

**Gilna et al, 11**- (Ben, Jennifer Kuzma, Stephanie Showalter Otts, Fenner School of Environment and Society, Australian National University, Canberra, Australi, Norwegian Center for Biosafety, Tromsø, Norway, Estacio ´n Biolo ´gica de Don ˜ana, CSIC, Seville, Spain, Humphrey School of Public Affairs, University of Minnesota, National Sea Grant Law Center, University of Mississippi School of Law, Kinard Hall, 26 November 2011, “Governance of genetic biocontrol technologies for invasive ﬁsh” Biol Invasions , Springer Link, DA)

International law is a challenging area. Treaties and agreements can be rendered almost useless due to the reluctance of a minority of nations to ratify them, or watered down to achieve agreement at the expense of impact. Overlapping treaties and agreements can still leave important gaps between them, and some nations may fail to put a regime into practice on the ground. Invasive species regulation is an exemplary case (Shine 2007).Nevertheless, internationalagreements can unify regulatory practice across borders, and establish a general and inﬂuential understanding of important issues even when nations decide not to participate ofﬁcially. The international level is there- fore important to GBC for invasive ﬁsh, affecting the manner in which GBC agents are handled within a nation, and—crucially for a technology that may be able to swim across borders—structure the manner in which nations will treat each other in dealing with GBC. The Convention on Biodiversity1 (1993; CBD or Convention) is the overarching international treaty pertaining to issues of ecology and biodiversity. It aims to provide an inﬂuential platform of governance for the global challenges and tensions between the use, beneﬁts and conservation of biodiversity. Article 8(h) explicitly instructs Parties to ‘‘[p]revent the introduction of, control or eradicate alien species which threaten ecosystems, habitats or species’’, but considers genetically modiﬁed organisms (GMOs) separately. Biotechnology is deﬁned as any techno- logical manipulation of biological systems, organisms or derivatives thereof, a deﬁnition that would encom- pass all agents in the GBC stable. As of mid-2012, 193 of 196 nations recognized by the United Nations are party to the Convention,2 (including the European Union). The USA has signed but not ratiﬁed or acceded3 to this treaty. The CBD is broad ranging and ambitious, but despite being set up to provide a speciﬁc and binding oversight regime for biodiversity, it has mostly failed to do so (Angulo and Gilna 2008b;HarropandPritchard 2011;McGraw 2002).ItsProtocols,however,aremoresubstantial. The Cartagena Protocol on Biosafety4 to the CBD is the preeminent instrument for the regulation of the products of GM technology at the international level.5 Although a few nations prominent in GBC science are not party to the Protocol (e.g., the USA, Australia), 163 nations of the world have ratiﬁed this treaty as of mid-2012.6 Laws and regulations related to biosafety are compiled on the Biosafety Clearinghouse web- site.7 The Protocol aims to ensure the safe handling, transport and use of living modiﬁed organisms (LMOs) that ‘‘may have adverse effects on the conservation and sustainable use of biological diver- sity, taking also into account risks to human health’’, with speciﬁc focus on transboundary movements. LMOs are any living organism that possesses a novel combination of genetic material obtained through the use of ‘‘modern biotechnology’’ (emphasis added), deﬁned as: In vitro nucleic acid techniques, including recom- binant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or b. Fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection; The Protocol therefore applies unequivocally to transgenic, cisgenic and intragenic GBC agents, but not to agents produced by mutagenesis or artiﬁcial selection. The chemical and physical techniques used to manipulatechromosomenumber,asproposedforTrojan Y ﬁsh (Cotton andWedekind 2007;GutierrezandTeem 2006),likelywouldbeexcludedfromitsreference.The CartagenaProtocol’sparticulardeﬁnitionoftheproducts of biotechnology is considerably tighter than that provided in the Convention, but does not provide a mandate to oversee all forms of GBC agents. Parties are required to minimize risks of LMOs to biodiversity and human health and to prevent uninten- tional transboundary movements. Other than to mandate the provision of relevant information to an affected country, the Protocol does not specify appropriate responses were a dangerous LMO to cross into another nation.Intermsofcompliance,theProtocoliseffectively toothlessandmiredinongoingnegotiationsonthematter. The Cartagena Protocol is not therefore irrelevant to genetically modiﬁed ﬁsh for biocontrol, but limited to subset of applications (e.g. transgenic ﬁsh) and even then without much prescription. However, liability for damage incurred by LMOs (next section) may be more pertinent for situations where such modiﬁed ﬁsh might cross borders.

#### **A new protocol to an International Treaty needs to be formed before the GM fish are released**

**Gilna et al, 11**- (Ben, Jennifer Kuzma, Stephanie Showalter Otts, Fenner School of Environment and Society, Australian National University, Canberra, Australi, Norwegian Center for Biosafety, Tromsø, Norway, Estacio ´n Biolo ´gica de Don ˜ana, CSIC, Seville, Spain, Humphrey School of Public Affairs, University of Minnesota, National Sea Grant Law Center, University of Mississippi School of Law, Kinard Hall, 26 November 2011, “Governance of genetic biocontrol technologies for invasive ﬁsh” Biol Invasions , Springer Link, DA)

In the face of signiﬁcant deﬁciencies in GBC oversight (for ﬁsh and other taxa), we make several recommen- dations at a variety of levels. Serious consideration should be given to a new international treaty, one that can encompass all of GBC regardless of the agent’s mode of creation or its application. It is important to make the regulation of GBC distinct from the regulation of commodity-trade GMOs like crops. Trade in and production of agro- industrial commodities involves economic consider- ations that easily dwarf invasive and pest species issues (important as they may be), whose worth to national economies has already alienated several important governments from the preeminent interna- tional framework for biosafety regulation (the CPB). Further, GBC involves a particular combination of biological and ecological processes that have no counterpart in agro-ecological systems. The moral, social and political issues in invasive species, biodi- versity conservation and exploitation invoke a differ- ent network of actors and concerns than do GM crops. The new treaty should form another Protocol to the CBD, and should be explicitly recognized by the WTO due to its quarantine and trade restriction implications. Although we have used the concept of modiﬁed biological control (i.e., GBC) as an analytical focus in this article—and we argue there is indeed something consequentially different about GBC compared to conventional biocontrol—it may not be the best concept around which to construct such a treaty. Serious consideration should be given to the inclusion of non-GBC biocontrol agents, and close interface with existing invasive species regulatory regimes makes a good deal of practical sense. New Zealand’s ‘‘new organisms’’ approach might be a useful template upon which to establish a new regime. Very strong consideration needs to be given to the consequences of GBC agents for other nations, who may value the target species very differently than one’s own. Even within nations, different groups will have different values and visions that deserve to be considered in GBC governance. This illustrates the need for a deliberative and responsive approach in governance, and it is not unique to GBC. Some nations already have been prompted to engage in wide- reaching projects of review, reacting to the pressures and politics that contemporary and future develop- ments in biotechnology seem to have in store (e.g., New Zealand held a Royal Commission on genetic modiﬁcation; Ministry for the Environment 2001). Options for GBC governance could proﬁt from the intense work occurring in other technological ﬁelds to improve its own. A variety of approaches are possible (some quicker to establish than others), such as formal inter-agency coordination, a range ‘‘hard’’ and ‘‘soft’’ approaches to regulation, changes to funding priorities and incentive structures, and a variety of forms of public dialogue. A four-year review of nanobiotech- nology in the United States made similar ﬁndings, advocating a dynamic approach to oversight of this rapidly developing ﬁeld (Ramachandran et al. 2011). Scientists in GBC must engage with these matters, although the legal, ethical and societal issues might not always align squarely with their natural science expertise. This is partly an interdisciplinary challenge, necessitating engagement with social science and other forms of scholarship (e.g., law, politics). Researchers must be cognizant of the interdependency between ﬁelds so apparently distant as malaria reduc- tion, rabbit conservation and invasive ﬁsh control. A proactive engagement with policy-makers, the public, and research sponsors (e.g., funding agencies, philanthropies and private companies) is essential. Similarly, managers and other would-be users of these technologies must also become proactive, engaging with the science and the governance systems in which they are embedded, and reaching out with meaningful engagement to the citizenry affected. The complexi- ties of the science and the discordant heritage of the last two decades’ GM crop debate mean that the potential for either or both blanket bans or deﬁant, deleterious releases of GBC agents remains very real.

## Politics Links

#### Congress does NOT like the plan

Hauter 11, Wenonah, Executive Director Food & Water Watch, Congress Unites Against FDA Approval of Genetically Engineered Salmon, <http://www.foodandwaterwatch.org/pressreleases/congress-unites-against-fda-approval-of-genetically-engineered-salmon/>, ACJ

Washington, DC – “On Tuesday, a bi-partisan group of U.S. House Representatives introduced critical legislation (H.R. 521) mirroring a Senate bill from the end of January (S. 230) to keep the first genetically engineered (GE) food animal, AquaBounty Technologies AquaAdvantage salmon, off our plates. The controversial fish, which the FDA may approve any day now despite widespread opposition from the public and many federal lawmakers, has potentially disastrous consumer health and environmental consequences.” “It is significant that Congress is united in taking a strong stand against this risky experiment. Food & Water Watch applauds Representatives Young, DeFazio, Jones, Polis, Stark, and Wu along with Senators Begich, Murkowski and Murray for overcoming party divides to join together in protecting U.S. consumers from this largely untested product.“ “Over 90 percent of the public does not want the FDA allowing GE meat into our food supply and even experts at federal agencies like the U.S. Fish & Wildlife Service recognize environmental concerns. Why the FDA continues moving toward approval is baffling. To approve GE salmon now would represent flagrant disregard for the legislative process and the concerns loudly expressed by the U.S. public.” “At least 30 House members and 14 senators have written the Obama administration either expressing serious concerns about the manner in which the FDA conducted its review of Aquabounty’s GE salmon, or calling for the outright prohibition of its approval for human consumption. So why isn’t the FDA listening

#### FDA and Congress in clear opposition on GM fish since 2011

Reporter, Daily Mail. "No 'Frankensalmon' in America: Congress Bans FDA from Approving Genetically Modified Fish." *Mail Online*. Associated Newspapers, 16 June 2011. Web. 27 June 2014. <http://www.dailymail.co.uk/news/article-2004315/Congress-bans-FDA-approving-genetically-modified-fish.html>.

Genetically modified salmon will not go on sale in the U.S. The House of Congress has voted to ban the Food and Drug Administration from passing the fish fit for human consumption. The FDA had said last year that they thought the fish, which grows twice as fast as normal salmon, appeared to be safe. The House of Congress has voted to ban the Food and Drug Administration from passing the genetically modified salmon fit for human consumption. And they were expected to rule on the modified food later this year. But an advisory panel had indicated that more studies would be needed before it could be served on the nation's dinner tables. If the FDA had approved the salmon it would be the first time the government allowed such modified animals to be marketed for human consumption. The salmon which grows at double-speed was created by Massachusetts company AquaBounty. They claim it is safe and environmentally sustainable. But Alaskan Republican Don Young moved to block the move and offered an amendment to a farm spending bill on Wednesday that would prohibit the FDA from spending money to approve AquaBounty's application. The amendment was passed and The House is expected to pass the bill later this week. Young argued that the modified fish would compete with wild salmon in his state. Other critics have labelled the modified salmon a 'frankenfish' that possibly could cause allergies in humans and eventually decimate the wild salmon population. AquaBounty has added a growth hormone from a Chinook salmon that allows the fish to produce their growth hormone all year long. The bioengineers were able to keep the hormone active by using another gene from an eel-like fish called an ocean pout that acts like an on switch for the hormone, according to the company. Conventional salmon produce the growth hormone for only part of their life cycle. The FDA has appeared favorable toward the engineered fish, saying there are no biologically relevant difference between the engineered salmon and conventional salmon and there is a reasonable certainty of no harm from its consumption. The agency is also considering whether the fish needs to be labelled as modified. Approval would open the door for a variety of other genetically engineered animals, including a more environmentally-friendly pig that is being developed in Canada or cattle that are resistant to mad cow disease. Each would have to be approved by the FDA. The Senate has not ruled on the issue. Congress bans FDA approval against GM fish Hauter, Wenonah. "Congress Unites Against FDA Approval of Genetically Engineered Salmon." Food Water Watch General. Food Water Watch General, 10 Feb. 2011. Web. 27 June 2014. <http://www.foodandwaterwatch.org/pressreleases/congress-unites-against-fda-approval-of-genetically-engineered-salmon/>. Washington, DC – “On Tuesday, a bi-partisan group of U.S. House Representatives introduced critical legislation (H.R. 521) mirroring a Senate bill from the end of January (S. 230) to keep the first genetically engineered (GE) food animal, AquaBounty Technologies AquaAdvantage salmon, off our plates. The controversial fish, which the FDA may approve any day now despite widespread opposition from the public and many federal lawmakers, has potentially disastrous consumer health and environmental consequences.” “It is significant that Congress is united in taking a strong stand against this risky experiment. Food & Water Watch applauds Representatives Young, DeFazio, Jones, Polis, Stark, and Wu along with Senators Begich, Murkowski and Murray for overcoming party divides to join together in protecting U.S. consumers from this largely untested product.“ “Over 90 percent of the public does not want the FDA allowing GE meat into our food supply and even experts at federal agencies like the U.S. Fish & Wildlife Service recognize environmental concerns. Why the FDA continues moving toward approval is baffling. To approve GE salmon now would represent flagrant disregard for the legislative process and the concerns loudly expressed by the U.S. public.” “At least 30 House members and 14 senators have written the Obama administration either expressing serious concerns about the manner in which the FDA conducted its review of Aquabounty’s GE salmon, or calling for the outright prohibition of its approval for human consumption. So why isn’t the FDA listening?

## K Stuff

### Anthro Link

#### Genetic Engineering Unethical-Hurts animals

Jiv Daya ’11- We aim at helping members of the Indian community to live by the principle of Ahimsa – fundamental to Indian philosophy -- in the American context. Having as our guiding motto, our objectives are to educate, promote, and support lifestyles that are harmless in theory and in practice. We can live, even in this country, without exploiting poor animals, “How Far is it Ethical?” http://www.jivdaya.org/genetic\_engineering.html

Genetic engineering on animals is highly undesirable, unnatural and therefore unethical. Some rationalists believe that it is tantamount to tinkering with nature’s pre-planned programme. Once modified, the individual genetic ‘personality’ of the animal stands irreversibly altered. It is used AGAINST the well-being of animals rather than FOR their welfare.¶ ¶ Genetic engineering is highly immoral because of four robust reasons:¶ ¶ 1. Although lower in the order of evolution animals are very much sentient beings which means that they are capable of feeling pleasure and pain in the same way as we do.¶ ¶ 2. In the case of humans, their permission is taken for genetic engineering. Further, for certain experiments, they are paid ‘inducement money’ and in the case of failure, they are given a generous compensation. In contrast, in the case of animals, genetic engineering is done without their permission or any compensation which is patently mean and unfair.¶ ¶ 3. Animals being speechless and defenseless, cannot run away (all escape routes are blocked), resist (they are held down), protest (they are muzzled), or lodge a police complaint nor can they move the court for redressal of their grievances.¶ ¶ 4. There are psychological perspectives also. Like human mammals, animal mammals also develop great attachment towards their young. And when any of the young is forcibly separated from the mother, she feels sad and expresses her sorrow. Early weaning leads to abnormal behavior and pathological changes in the small intestine. Even rough handling affects their psyche. Fear of humans reduces the reproductive performance of animals. Further, in cloning of animals (say cow, buffalo, pig, rabbit, mouse etc.) multi-identical offspring are born. The mother becomes attached to her young and each offspring’s separation from her causes mental shock and plunges her into depression. Repeated cycles of this trauma leaves her heart-broken. This is mental cruelty.¶ ¶ Thus, the prime motive for using genetic engineering on animals is not for any real concern for or welfare of them but solely and ultimately for the benefit of man. In other words, all gains go to man and nil to animal -- it stands to lose its health, limb or life for man.¶ ¶ To test the validity of my views, I put the same question to Hindu Swamis, Jain Munis, Buddhist Monks and Sikh Saints. At first they frankly said that they had absolutely no idea as to what genetic engineering was. On my briefly explaining the application of genetic engineering to animals, all of them gave more or less the same answer:¶ ¶ The Swamiji said: "According to our Vedas, all living beings have a soul. It is an infinitesimally small part of the Universal Soul (Parmatma) seated in the heart of every being (Jiv Atma). Our religion forbids killing of any animal and exhorts to be kind to them. Now if genetic engineering causes any pain or suffering to animals, then it is definitely not right and it would be very cruel to forcibly subject them to it because as you say, it doesn’t benefit them. It only harms them. Narayan! Narayan!"¶ ¶ The Jain Muniji said: "We hold that all life is precious - be it human or animal. But unfortunately the sanctity of animal life is not recognized and if, during the course of genetic engineering it loses its life, no remorse is felt. The dead body is just carted away. Bhagwan Mahavir has summed up this philosophy very succinctly thus: ‘What we cannot give, we have no right to take. We cannot give life, so we have no right to take life."¶ ¶ The Buddhist Monk nodded his head in agreement and added: "Buddhism is essentially a religion of kindness, humanity and equality. It is against animal sacrifices. So those who do these kind of things (genetic engineering) are deviating from the right path. They seem to have only passion for experiments (Paryog) but no compassion for animals."¶ ¶ The Sikh mystic in his typical Punjabi-accented Hindi opined: "We accept the cyclic Hindu theory of ‘Samsara’ - birth, death and rebirth - and karma. Humans are, therefore, equal to all other creatures - big or small. Conversely, all animals are sentient beings and therefore no pain should be inflicted on them. Because who knows that in our next birth, we may be born as an animal. That is why genetic engineering should not be performed on them." To make his point clear, he added: "There may be grounds for valuing the life of a person more highly than that of an animal. But these, however, are not grounds for ignoring or devaluing the life of an animal for the simple reason that the basic characteristics (of divine life) are present to some degree in all animals."

### Cap Framing Card

#### Their research is biased and capitalist-Reject their truth claims

Kamila '10 (Avery Yale Kamila, staff writer for Portland Press Herald, "Case for genetically altered salmon doesn't hold water," Portland Press Herald, Lexis, ST)

If you happened to catch my column last week, you'll recall that I wrote about the bid by biotech firm AquaBounty to get its fast-growing, genetically engineered Atlantic salmon approved by the Food and Drug Administration. I discussed the company's submission of sloppy research and the FDA's disregard of public comment on the matter. Since Maine is a traditional fishing state and Atlantic salmon are native to our waters, should this transgenic fish be green-lighted to enter our food supply and environment, it will impact our state directly. If approved, this would be the first genetically altered animal approved for human consumption. Today, I pick up where I left off by examining AquaBounty's claims that its transgenic fish is safe to eat, won't escape into the wild and will help solve world hunger. Do for-profit companies really care about the world's hungry? One of the main arguments AquaBounty makes in advocating for approval of its genetically altered salmon is that the fish, which has growth hormones spliced into its genetic code that force it to grow twice as fast as normal salmon, will help feed the world's hungry. Sounds like a laudable goal, but is it plausible? In her recently updated and reissued book ''Safe Food: The Politics of Food Safety'' (University of California Press), New York University nutrition scientist Marion Nestle writes, ''because developing countries lack a viable market for such products, few agricultural biotechnology companies can afford to invest in solutions to the food problems of the developing world.'' Translation: For-profit companies are out to make a buck, and poor people (and their governments) don't have the cash to pay for high-tech food. Nestle goes on to talk about the much-hyped Golden Rice, a genetically engineered strain that its producer promises to cure Vitamin A deficiencies in the developing world. Nestle suggests that should the rice ever make it to market (which is a big if), it won't be a humanitarian gesture but a public relations ploy designed to gain consumer acceptance of genetically engineered foods and refute arguments that corporations only care about the bottom line. Is it reasonable to assume a new organism won't escape into the wild? AquaBounty has repeatedly claimed its salmon doesn't pose a threat to wild salmon because it will be raised in inland fish farms and will never escape. But fisheries experts disagree. The Penobscot East Resource Center in Stonington joined 24 other fisheries advocacy groups, including two others in Maine, in sending the FDA a letter opposing the approval of AquaBounty's salmon. ''Our mission is to secure the future for fishing communities in Eastern Maine,'' said Aaron Dority, who directs the organization's groundfish initiatives. ''And we see genetic engineering as a threat on a number of fronts.'' Dority said the organization is concerned about the pollution that results from fish farms (basically a form of factory farming done in the water) and asserted that it will be ''only a matter of time'' before the altered fish escapes into the wild. The tendency for nature to wrangle out of human-imposed confines has been demonstrated numerous times with genetically modified food crops. John Jemison, a scientist who works with the University of Maine's Cooperative Extension and serves on the Maine Board of Pesticides Control, has conducted a number of field studies exploring how genetically engineered crops behave in the real world. In 2002, he published research in the AgBioForum journal exploring the likelihood of genetically engineered corn transferring its altered genes to non-GMO corn grown nearby. His research and similar studies show that gene transfers regularly take place. Bob St. Peter, who heads Food for Maine's Future, a group that advocates for local rather than corporate control of the food supply, noted that ''when you radically alter an organism and make it do something it doesn't do naturally, the consequences will be unforeseen. You have to assume at some point this salmon is going to enter the ecosystem.'' Should we rely on corporations to determine what is safe? AquaBounty claims its salmon is safe to eat and fundamentally the same as wild salmon. But should we believe AquaBounty in the absence of independent scientific research?